DIET AND FOOD

Considered in relation to Strength and Power of Endurance, Training and Athletics.

BY

ALEXANDER HAIG, M.A. & M.D. Oxon., F.R.C.P.

Physician to the Metropolitan Hospital, and the Royal Hospital for Children and Women;

AUTHOR OF "URIC ACID AS A FACTOR IN THE CAUSATION OF DISEASE."

SECOND EDITION.

WITH FIVE ILLUSTRATIONS.

London:

J. & A. CHURCHILL,

7, GREAT MARLBOROUGH STREET, W.

1900.


JOHN BALE SONS
and DANIELSSON Ltd
STREET
LONDON

PREFACE TO SECOND EDITION.

THE short interval that has elapsed since the publication of this little book, seems to justify the opinion of those who asked me to produce it, that it would supply a want. In now bringing the information it contains up to the level of my recent experimental work, it is my earnest hope that it may continue to supply a want.

Nothing has occurred since I wrote the Preface to the first Edition to diminish my belief in the far-reaching importance of the subject; much has occurred to strengthen it, and that importance is, I believe, absolutely invisible only to those who have never thought of it; while I am coming to see ever more and more clearly that men indeed are what they eat.

7, BROOK STREET, LONDON, W.

January, 1900.

PREFACE.

In attempting to alter people's diet so as to free them from the poisonous xanthins and uric acid, I have met with so much ignorance, and its results prejudice and superstition, that I have been led to write these pages in the hope of making rather clearer the position that diet holds in relation to these matters of strength and nutrition.

And I believe that I speak no more than the truth when I say that once a clear knowledge of the facts is obtained and a workmanlike and useful grasp of the subject is attained, it will be found that in diet lies the key to nine-tenths of the social and political problems that vex our nation and time.

Diet, as at present used, is often the product of a vast amount of ignorance; it is the cause of a hideous waste of time and money; it produces mental and moral obliquities, destroys health and shortens life, and generally quite fails to fulfil its proper purpose.

It is my object in the following pages to show that it may be easily made to fulfil its proper pur-

pose, and that with even a partial removal of the ignorance that surrounds it, the waste of time and money may be prevented, and the dangers to life and health averted.

But after pointing out the possibility I shall leave the facts to speak for themselves, as those will most completely understand them, who put them to the test of experience.

7, Brook Street, London, W.

August, 1898.

CONTENTS.

ILLUSTRATIONS.

DIET AND FOOD.

CHAPTER I.

Some Points in the Physiology of Albumen and Urea.

Health may be defined as a satisfactory condition of nutrition, strength, and power of endurance.

In considering how such a satisfactory condition can be produced we shall have to treat of the albumens of the food, their sources, characters, digestibility and the amounts of force and urea derived from their metabolism in the body.

In far off olden times, when man was a more natural and less refined animal than at present, Nature managed the whole business for him, and he either died or attained to a satisfactory condition of health and nutrition without knowing how or why.

But when later on he began to control some of the conditions of his own nutrition without having obtained a thorough comprehension of all their

bearings, he here, as in so many other points of contact with Nature, upset her scales and balances without being prepared to substitute any more satisfactory ones in their place, and suffered in consequence from many unexpected and terrible results of his rashness.

And even now many men are attempting to carry the diet of youth on into middle life and age, or the diet that was quite correct for an active outdoor life into a life of sedentary office work in a town; or if they fall into neither of these errors they are generally completely ignorant with regard to the relative value and importance of foods, so that they either starve themselves on vegetables or herbs containing little or no albumen, or, on the other hand, over-feed themselves on the most concentrated albuminous foods.

Now to prevent such mistakes and to substitute a certain amount of scientific precision for the previous rule of thumb methods is the object of this little book, and so we may say that the first essential of nutrition is the supply to the blood of sufficient albumen to replace that transformed into urea in the production of force.

If food is withheld urea goes down and down, and with it falls the power of producing force in active exercise.

Fig. 1 shows in a curve the hourly excretion of urea in the sixteenth, fifteenth, fourteenth and

earlier hours of a fast, no food having been taken since 8.30 p.m. on the previous day.

We see, then, that in the hour ending at 8 a.m., urea is a little above 13 grains and it rises in the

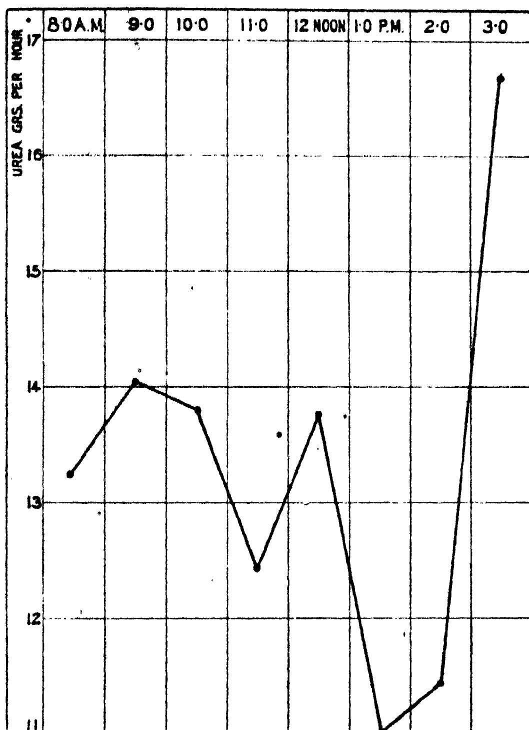


FIG. 1.—Effects of fasting and food on the excretion of urea.

hour ending at 9 a.m. to a trifle above 14 grains; this is probably the result of the exercise involved in the acts of washing and dressing.

At 10 it falls, and at 11 is only about 12·5 grains,

but at 12 it rises again nearly to 14 grains as the result of some exercise, only to fall more quickly and decidedly down to 11 grains at 1 p.m. At 1.5 food is taken and at 2 there is a rise, but only a slight rise, to 11·5 grains; at 3, however, the full effect of the meal begins to be felt and it rises with a bound to 16·7 grains per hour. The total for the day being a little over 400 grains, or 17 grains per hour.

We see, then, from this figure, that the effect of withholding food for sixteen hours is a steady fall of urea (only the latter part of which we see here), from 17 grains or more per hour down to 11, but this fall is broken from time to time by the effects of exercise which appears to call out some albumen or nitrogen from some reserve store, about which more presently.

We also see that with this fall of urea there is a steady corresponding diminution of strength and power of endurance, that is, of force production, and that with the rise of urea, which at 3 p.m. follows the taking and digestion of food, there is an equally marked rise of general strength and power.

We see, then, that the excretion of urea is the measure of the force available, and that its falls and rises accurately register the conditions of the nutrition, strength, and endurance of the body.

We know also that this urea is generally obtained from the nitrogen in the form of albumen contained in food, that there is also a certain amount of stored albumen in some of the tissues, and that in

prolonged starvation, nitrogen is further provided by destruction of the tissues themselves, this being accompanied by a definite daily decrease in body weight.

We shall see that such loss of body weight is an exact measure of the albumens consumed, and of the urea and force produced from them.

So that when the condition arrives that there is no more albumen available for absorption, no more reserves and no food, urea and force alike cease to be produced, and life comes to an end.

From this we may conclude that urea excreted is an exact measure of force produced, and that albumen available is also an exact measure of the force that can be produced. (See also chap. iv.)

We shall see also that as I have already suggested in "Uric Acid"[1] as the result of other researches, that those who believed that strength could be got out of food containing no nitrogen and that urea was therefore not an absolute measure of strength and power, had flaws in their premisses which seriously affected the value of their conclusions.

I mention this here because the relation between urea, albumen and force is the key note of this volume; but I shall have much further evidence to

---

[1] "Uric Acid as a Factor in the Causation of Disease." Fourth Edition. J. & A. Churchill. London: 1897, Pp. 279, 284.

bring forward on the subject in the pages that follow.

Further, as a result of watching my own excretion of urea for many years (see details in "Uric Acid") and on all kinds of diets, I have come to the conclusion that given a sufficient amount of albuminous food that can be digested and metabolised in the body into sufficient urea, I can produce force proportional to that urea without much regard to the quantities of other non-albuminous foods taken.

So that while I do not mean to say that sugar, starch and oil do not, under certain conditions which I shall demonstrate presently, affect the production of urea and force, their influence is always indirect, and generally of so little importance that in a purely practical work like the present it may be neglected.

We are now at once met by the question, How much urea and how much albumen are sufficient? and as most physiologists are agreed that good strength and nutrition in adult life can be maintained on about 3½ grains of urea per lb. of body weight per day, and as my own researches (see "Uric Acid," fourth edition, p. 614, *et seq.*) are in substantial agreement with them, I shall adopt this standard without further consideration here.

Then it is a rough but sufficiently accurate rule that the albumens required to produce any given quantity of urea can be found in grains by multiplying the grains of urea by 3.

So that if we take the weight of any individual in pounds and if there is much adipose tissue deduct it, or take the body weight (if known) before the adipose tissue was added, and multiply this by 3, if life is sedentary, and by 3-5 if life is active, we get the urea required, and if this is again multiplied by 3 we shall get the albumens required to produce it.

Example.—A man weighs 160 lbs., but his active weight twenty years ago before he became stout was only 130 lbs., and he is now sedentary; therefore $(130 \times 3 \times 3) = 1,170$; and 1,170, or, say 1,200 grains of albumen per day will be required for his proper nutrition and force production.

But if such a man leads, or wishes to lead, a decidedly active life, multiply $130 \times 3\text{-}5 \times 3$ and 1,365 grains of albumen would be required each day.

Old people produce much less urea, say down to 2 grains per lb. per day; thus an old man might only require $130 \times 2 \times 3 = 780$ grains of albumen and he would also, of course, produce much less force.

Children, on the other hand, require much more, and may produce 6-8 and even 10 grains of urea per lb.; thus a child of 35 lbs. may require $35 \times 10 \times 3 = 1,050$ grains of albumen per day.

An interesting instance of this came under notice in the case of a boy aged 10, admitted into the

Royal Hospital for Children and Women, suffering from albuminuria and having a normal temperature.

He was put on a diet of milk only, by accident he was given $2\frac{1}{4}$ pints, an insufficient quantity of albumens.

On this he lost weight to the extent of 7 lbs. in eleven days, his weight on admission being 53 lbs.

Now the albumen in $2\frac{1}{4}$ pints milk	= 590 grs.
And the albumen in 10 ozs. of his own tissues containing say, 18 per cent.	= 786 grs.
	1,376 grs.

So that we get 1,376 grains of albumen as the quantity this boy required each day, and this divided by 3 gives 458 grains of urea, or 8·6 grains per lb. per day on his original weight of 53 lbs.

Now this is very interesting, as Nature here made up the deficit and told us how much albumen and urea per lb. this boy required, and I have often found children of this age excreting urea to about the quantity thus calculated, and younger ones still more per lb.

As soon as the mistake was discovered the milk was increased, the loss of weight ceased, and the amount lost was slowly regained.

Precisely the same results have often been produced in adults who for one reason or another have starved themselves, and here again the urea excreted

would be found to correspond to the albumens swallowed and the tissues absorbed.

I may remark also that those who starve themselves may feel very bright and well at first, after the usual gastric symptoms of discomfort give way; as they are being nourished on a stimulating flesh diet from their own tissues, and are saving some of the force usually expended on digestion.

But later on, when their reserve of albumens has long been used up, and their tissue albumens begin to get low, they may discover that they have been living on capital which should never have been touched, and which is difficult to replace; for with all their forces, including that of digestion, at a low ebb, it will take them a comparatively long time to assimilate sufficient albumens to keep the machine working as well as to replace the lost capital. And these considerations sufficiently account for the fact of which I have seen many instances, that those who put themselves on an unaccustomed diet often dangerously diminish their allowance of albumens for some time before they discover that there is anything wrong, and then find great difficulty in getting back to physiological levels.

Given sufficient albumens, it is a matter of very little consequence where they come from, whether from the animal or vegetable kingdom, though, of course, where poisons are swallowed with the albumens, these will influence the results, as we shall

see further on; but the first point is a sufficient quantity of albumen, and this in a condition suitable for digestion and absorption.

With these simple facts kept ever in mind there is no difficulty at all in getting sufficient albumen, and therefore sufficient strength and nutrition, out of many kinds of food besides those which form the staple diet of England to-day.

But those who have been ignorant of these facts, and have attempted to walk without the light of knowledge, have fallen into many and great errors, but chiefly in one of two directions.

Either they have been ignorant of the quantities required, and have greatly over-estimated the nutrition values of garden vegetables and garden fruits, attempting to live on these alone, which it is almost impossible to do. Or they have under-estimated the nutrition values of such things as milk and cheese, and attempted to eat them in as large quantities as the above fruits and vegetables.

It is also possible, by introducing more food than can readily be digested, to overpower digestion, so that nothing is digested and absorbed and starvation results, a fact which is brought to the front in the most interesting manner in the writings of Dr. Dewey.[1]

---

[1] "The True Science of Living," by E. H. Dewey, M.D., Norwich, Conn. The Henry Bill Publishing Company, and J. and J. Bumpus, Ltd., Oxford Street, London, England. 1895.

We learn then from fig. 1 that as supplies run short, urea, and the power of force production fall

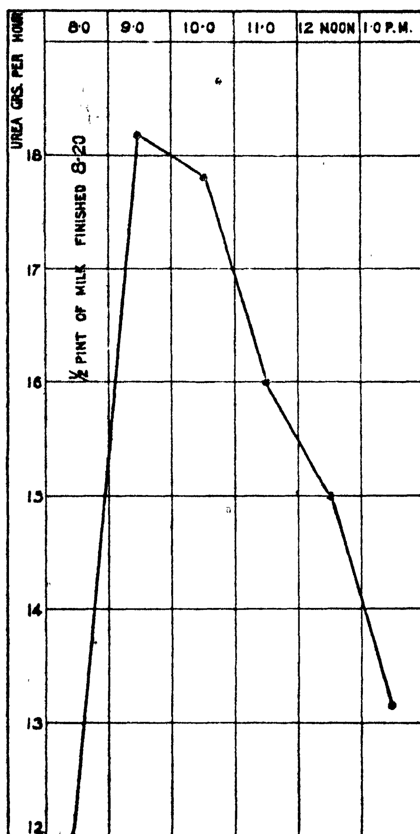


FIG. 2.—Effects of milk on the excretion of urea.

lower and lower, but that a supply of food does when digested, and generally in the course of thirty

to ninety minutes introduce into the blood a fresh supply of albumens available for the production of force and urea, and then up goes the urea curve, and the power of producing force is correspondingly increased.

And this is a very simple experiment which any one can repeat on, in, and for themselves.

Fig. 2 shows the effect of a similar fast to that of fig. 1, broken in the thirteenth hour after 8 p.m., by the taking of ½ pint of milk.

Here in the hour ending 8 a.m., urea is at 12 grains per hour and it rises at 9·0 above 18 grains and gradually falls from that on till 1 p.m., when it is about 13 grains per hour. Now if we take it that urea, if no food had been taken, would have gradually fallen from 12 grains per hour to 9·5 grains per hour at 1 p.m. and draw an imaginary line accordingly, the urea enclosed between these two lines will equal that produced in five hours from the albumens of milk taken, and this is about 28 grains or almost exactly ⅔ of the calculated urea value of ½ pint of milk, and probably the rest would have been obtained, only longer time was necessary for it to come out. Similarly with cheese and other foods their urea value to some extent comes out in five hours following ingestion, and thus roughly the nutrition value and digestibility of many foods may be directly tested on any individual about whom the information may be required.

Thus fig. 3 shows the effect of taking at 8.15 a.m. 1 oz. of cheese. Here we see that in contrast with what happened with milk, it is only in the second hour after the cheese that we get a rise of urea.

Then considering that urea would have fallen much as in the other figures, if no cheese had been taken, we get urea enclosed between the two lines equal to 17·7, say 18 grains, and this multiplied by 3 is equal to 54 grains of albumen.

But this cheese is theoretically equivalent to 140 grains of albumen, so that in five hours of digestion we have got less than half its urea and albumen value.

This looks as if cheese is both harder and slower of digestion than milk, and is probably after all less completely digested and leaves greater undigested residues.

I must say, however, that the cheese taken was Gruyère, and it was somewhat hard from keeping, which probably accounts for part of its slow digestion and indigestibility; still I give the result to show how the probable nutrition value of foods may be gauged by this process.

Many people say that they cannot digest milk or cheese; but a few tests similar to these would soon show whether there was any truth in the statement.

Fig. 4 shows the effect of swallowing 1 oz. of brown sugar, which was finished at 8.40 a.m.

Here we see a very marked rise of urea, from 13

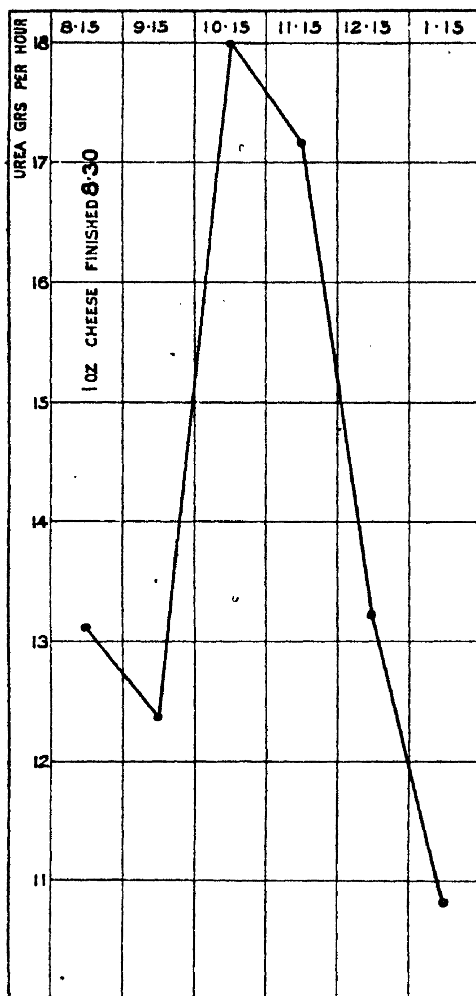


FIG. 3.—Effects of cheese on the excretion of urea.

grains in the hour ending 9.10, to 16 grains in that ending 10.10, followed by a fall down to 11·5 grains in the hour ending 1.10 p.m.

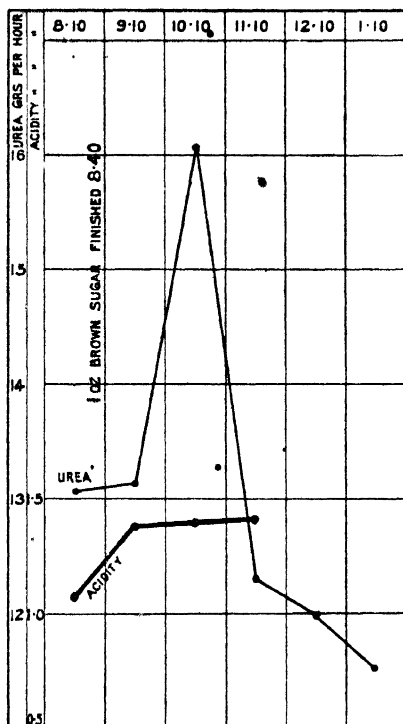


FIG. 4.—Effects of sugar on the excretion of urea and of acid.

Now this rise of urea cannot be directly due to the sugar, for it contains no nitrogen, but the result is probably due to the rise of acidity which precedes it.

In the curve below urea is shown the excretion of acid in the urine in grains per hour, and from this we see that there was a marked rise in the excretion of acid in the hour ending 9.10, and that it kept at the same level in the two following hours.

Now readers of "Uric Acid" already know that every rise of acidity is accompanied or followed by a rise of urea. And we gather from works on physiological chemistry that the rise of acidity which sugar produces is due to the effects of lactic and butyric fermentation in the alimentary canal.

This, no doubt, also accounts for the bad name which sugar has had for many years as a producer of gout and rheumatism ; though we can now see that sugar merely produced these troubles indirectly by its effects on acidity and the solubility of uric acid, and that if uric acid supplies are kept low, while the supply of fresh vegetables and fruits is good, sugar can do no harm. In a word, the trouble with sugar has arisen from associating it with animal flesh ; while taken with plenty of vegetables and fruits it is harmless. The rise of acidity shown in our figure would do no harm to a frugivore, but in a flesh-eater it might precipitate an arthritis.

And this rise in acidity was probably due to the sugar, as normally the rise in the acidity of the urine does not begin till 10.0 a.m., and when it begins it generally continues to rise slowly all the

way to 2.0 or 3.0 p.m. (see "Uric Acid," fig. 3), but this rise, beginning at 9.10 a.m., does not increase in the two following hours.

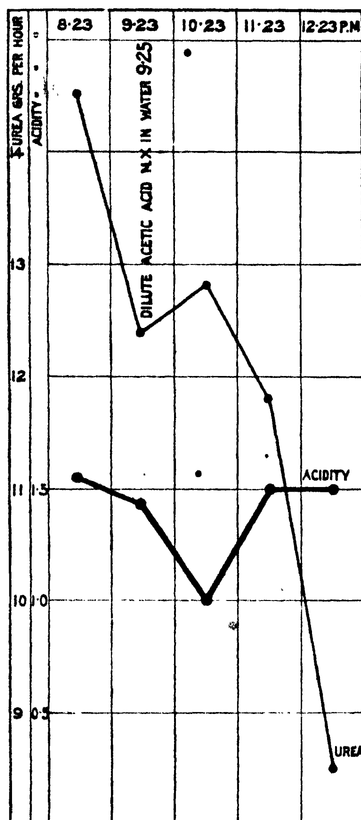


FIG. 5.—Effects of an acid on the excretion of urea and of acid.

Now fig. 5 shows a similar curve, in which at 9.23 ♏x. of dilute acetic acid were taken, and this is

2

followed by a break in the downward trend of the urea curve which, however, again falls rapidly to 8·5 grains in the hour ending 12.23.

Below the urea curve is the acidity curve, and this does not at once rise after the acid is taken, but in the hour ending 11.23 there is a decided rise, and this is not due to the normal rise at that hour, because it does not continue to rise in the hour ending 12.23.

I take it, therefore, that the rise at 11.23 was due to the acetic acid, and that the acidity (looking to the rapid fall of urea from 14 to 8·5 grains in about four hours) would have fallen further at 10.23 but for the acid taken, and that this acid affected the blood before its full effect became visible in the urine, and the rise of urea was the effect of the acid on the circulation of the blood. But it may be said, how was it that with a small rise of acid of ½ grain in fig. 4, there was a rise of 3 grains in urea, while with a rise of about 1 grain of acid in fig. 5 there was a rise of probably less than 2 grains of urea?

But as already shown in "Uric Acid," pp. 284 and 455, the rise of urea that follows the taking of an acid or a rise of acidity otherwise caused, is not proportional to that rise of acidity, but rather to the condition of the blood and tissues when the acid is taken and the rise of acidity affects them.

Now I have shown in "Uric Acid" that a rise of acidity causes a rise of urea, because it clears the

blood of uric acid which probably in colloidal form is obstructing the peripheral capillary circulation and preventing both the ready access of the blood albumens to the tissues, and the removal of waste products from these; and that the rise of urea which results is proportional, not so much to the greatness of the rise of acidity, but rather to the condition of the tissues at the time of the rise of acidity.

That is to say, the longer the tissue circulation has been exposed to the obstructing influence of colloid uric acid the greater may be the accumulation of waste products in those tissues and the greater will be the rise of urea when the circulation through them is once more freed. In illustration of this point I have remarked that while the rise of urea that follows the clearing of the blood of uric acid in physiological conditions, is only, as seen in these figures, a matter of a few grains; when the blood is cleared of uric acid in Bright's disease, where the obstruction to the circulation is both greater and more lasting, urea may rise as much as a hundred grains in a day.

Hence I conclude that the difference in the extent of the rise of urea in figs. 4 and 5 may be due to some difference in the quantity of waste products available in the tissues, and in conformity with this we see that urea was only falling rather slowly as the result of the fast in fig. 4, while at the same hours in fig. 5 it was falling very quickly indeed, and my notes of

the day corresponding to fig. 5 show that it was the day following a large excretion of urea after exercise, so that it is possible that the muscles were on this day rather poor both in stores of albumens and of waste products, and so the rise of acidity produced relatively little effect.

I have gone at length into this question of the effects of uric acid on circulation, nutrition and excretion of urea, because we here come in sight of our second great and important factor in nutrition, strength and power of endurance.

Our first factor, of which we have so far been talking, is a sufficient supply of albumens in a digestible form to introduce into the blood stream sufficient albumens to produce in the tissues urea to the extent of 3·5 grains per lb. of body weight per day, and the corresponding amount of force.

We can now see that our second factor is the possibility of a satisfactory circulation through the tissues, bringing these albumens to the tissues and removing the corresponding waste products.

And this, as we can now also see, is dependent on the absence of any excess of uric acid from the blood stream.

From which it follows that as some sources of albumens, such as animal flesh of all kinds, contain either uric acid or substances equivalent to it, such as the xanthins, these sources of albumen must be ruled out, for the blood cannot be kept properly

free from this substance while it is being continually introduced with every mouthful that is swallowed; and if the blood is not kept fairly free from this substance the circulation will not be that best suited to the production of strength and endurance. A fact of which we shall see some practical proofs further on.

But to return to figs. 4 and 5, I give them to show that the effect of 1 oz. of sugar (containing no albumens) on the excretion of urea, is very slight compared with the effect of 1 oz. of cheese, and that this small effect is probably indirect and due to the sugar altering the alkalinity of the blood and so affecting the circulation in the tissues and the removal of waste products from them.

We have thus far learned, then, that the production of force requires:—

(1) A sufficient supply of albumens in a digestible form.

(2) A satisfactory interstitial circulation of the blood to carry these albumens to the tissues and remove waste products, and to make this possible the blood must contain little or no uric acid or similar substances, such as the xanthins.

Before I leave the subject illustrated by the above figures of urea excretion, I will just point out that:— A small quantity of milk, cheese, or any food of similar albumen value causes a feeling that hunger is sated as the urea rises, and the feeling of hunger

begins to return again as urea falls; but if a food poor in albumens is taken, such as fruit, though in much larger bulk than the milk or cheese, there is a feeling of fulness, but hunger is not sated and there is little or no rise of urea. So that the feeling of hunger is to a large extent a measure of the want of albumens in the body, and this can be sated only by albuminous food, and 1 oz. of cheese is worth in albumens more than 10 times its weight of fruit, so that hunger is not a matter of mere bulk.

Similarly, if sufficient albuminous food is taken, but something upsets digestion, there is little or no rise of urea, no increasing feeling of strength and power, but rather a feeling of languor and debility with desire to keep quiet.

While good digestion is accompanied, so long as urea is rising, with feelings of strength and power and a desire to be up and doing, so that it is quite possible to tell whether digestion is good, bad, indifferent or *nil*, by these feelings alone.

Thus it is not uncommon to meet with people who, soon after eating a hearty meal start for some exercise, but within half an hour are found in a condition bordering on collapse at the side of the road; and if you ask them they will tell you that they have an intense feeling of emptiness referred to the epigastrium, as if all their good meal recently eaten had given them the slip.

What has happened here? Merely this, that the

exercise has been too much for gastric digestion, which has been suspended, so that though the stomach is full, there is no absorption of albumens into the circulation, no rising urea and no force available; and so in spite of a full stomach he has a feeling of more or less intense emptiness, which shows merely that the blood is poorly supplied with nutritive albumens, and we find that urea is falling, or at least, not rising.

A little rest puts matters right, the stomach circulation is restored, digestion goes on, albumen is absorbed and urea formed, and the man gets up and walks perhaps quite well for twenty miles, making almost as good use of his meal as if nothing had occurred.

On the other hand, it is possible that the temporary suspension of digestion may allow fermentative, putrefactive, and other processes to take place in the food mass, which continue and put digestion out for hours, days, or weeks afterwards.

A similar suspension of digestion, absorption and urea formation may be produced, with exactly similar results, by other disturbing influences besides exercise, such as the circulation changes produced by the rush of a quantity of uric acid into the blood, producing, as I have elsewhere explained ("Uric Acid," prev. ref., p. 217), obstructive congestion of the whole digestive circulation, and so

imperfection or suspension of gastric digestion, and the other results above mentioned.

And this is the causation of the gastric upset and vomiting, of the severe uric acid storm (or bilious attack, so called) and of the more or less sudden feelings of emptiness in cases of glycosuria and diabetes, associated with such and similarly caused circulation troubles and their effects on digestion.

And as readers of "Uric Acid" already know, every rise of uric acid in the blood and urine is accompanied by a fall in urea, which is no doubt partly due to defective circulation and metabolism in the muscles and other important tissues, the reverse effect to that shown in fig. 5, and also partly to defective circulation and digestion in the stomach, and consequent diminished absorption of albumen into the blood.

But if even at the end of the sixteenth, seventeenth, or eighteenth hours no food is taken, urea often begins to rise a little, and with this there comes a feeling of increased strength and power and the emptiness passes off or is greatly lessened.

This means, I believe, that the body has begun to feed on its own tissues, and that there is a rise of urea and of energy from this source; but prolong the fast for twenty-four to thirty-six hours and there is now a distinct loss of weight, as in the boy above mentioned, who was put on a diet deficient in albumens; and this represents the albumen neces-

sary to raise urea and produce the force required for the bodily functions, in the absence of supplies from without.

And this loss we know will be continued for weeks and weeks, and sufficient albumen will be taken each day to keep the chief functions of the body from coming to a standstill, and a corresponding amount of urea will be excreted.

We may sum up the main points in the physiology of the subject by saying that the first requisite for strength and power of endurance is a satisfactory and sufficient supply of albumens, that the body depends for these chiefly on the foods taken from day to day, but that there is also a small store of these substances in certain tissues which becomes available for use if prolonged exertion is called for in the absence of food, and further, that beyond this point in continued starvation certain definite quantities of the tissues themselves are daily absorbed to produce the necessary albumens and urea.

My results are thus in complete accord with the teachings of those physiologists who say that albumen is the *sine quâ non* of a diet that sustains life; and my researches, some of which I have published in "Uric Acid" (prev. ref., p. 611), show that the excretion of urea bears a definite relation to the force produced, and that a diet on which urea is at or below 2·5 grains per pound of body weight per

day will not suffice to produce much force, in spite of a liberal allowance of sugar, starch and fat.

Force is thus in all directions proportional to urea, whether gauged from hour to hour or day to day.

And the second requisite is a free circulation through the tissues to bring the albumens to them and remove their waste products, and this circulation is only possible in the comparative absence of uric acid from the blood stream; this absence explaining the rise of urea in fig. 5, and the still more marked rise if the blood can be cleared of uric acid in Bright's disease.

CHAPTER II.

Physiology and Pathology of Fatigue.

From what has already been said we gather that fatigue, that is, the inability to produce force, may be due to two causes: (1) a general dearth of albumens in the blood, and (2) a condition in the blood which leads to its defective circulation through the tissues, so that though the blood contains sufficient albumens the tissues cannot readily obtain them, and also the tissues become, as the result of their activity, laden with waste products, which are not sufficiently quickly removed.

It will be well to go somewhat deeper into this causation of fatigue, so as to obtain the power of distinguishing in practical experience, between the fatigue which is due to the first and that which is due to the second condition.

Now the fatigue which is due to dearth of albumens in the blood is always (except in the condition of dyspepsia mentioned in the previous chapter) absent so long as sufficient food is taken and digested; so that if a man in any trial of endurance drops out

while supplied with sufficient albumens and apparently digesting them, we may be sure that his fatigue is not due to (1), but by exclusion is probably due to (2).

And practically, and apart from digestive accidents, the fatigue which is due to dearth of albumens does not occur till some four or five hours after a meal, and till urea has begun to fall very considerably below the level of 17 grains per hour, as shown in figs. 2 and 3 for instance.

So that if a man who has had a sufficient supply of albumens put in, and has a good digestion, yet falls out in the early stage of a contest, long before those albumens can be exhausted, we must conclude that his fatigue is due to uric acid in the blood and may proceed further to identify this condition by considering its concomitant signs and symptoms.

As will appear from my consideration of this subject in ("Uric Acid," prev. ref., p. 285), there is, in addition to the feeling of powerlessness in the limbs, a feeling of chilliness, with coldness of skin and extremities, and a fall of the surface temperature, but the temperature in the rectum will be raised and separated more than usually from the surface temperature (sign of excess of uric acid in the blood): similarly, and for the same reason the general blood pressure will be raised, the diameter of the radial artery increased, and the sounds of the heart altered. Under this condition if a white spot is made by pressure with the finger-tip

on the back of the hand, the colour will take from 2 to 3 seconds or more to return; while where there is no excess of uric acid in the blood, it may only take from 1½ to 2 seconds.[1]

Now these are all effects of one and the same cause, defective capillary circulation, which can be seen on the back of the hand, affecting especially the temperature of surfaces and extremities, but affecting also the general circulation of the whole body, raising the blood pressure and influencing the action of the heart.

On the other hand, the man who suffers from fatigue owing to deficiency of albumens will not suffer from coldness nearly so much, will have but little difference between surface and deep temperatures, and little if any slowing of the capillary reflux on the back of the hand, will not have a general rise of blood pressure with increased diameter of the arteries, or much alteration of the sounds of the heart.

This man is all right in himself, but supplies have merely run short; give him fresh albumens, and a little time (as we see from fig. 1 is required) to digest them, and he will promptly be himself again; or even a little rest without any fresh albumens, will enable him to draw on his reserves and tissue albumens, and he will be able to go on once more.

[1] See *British Medical Journal*, Oct., 1899.

Far different is the case of the other man, for even if you supply him with albumens it will do but little good, he has already sufficient in his blood, but they cannot get to the tissues, and owing to the general defective circulation his digestion of any new albumens will be as slow as all his other physiological processes.

To supply him with fresh food may merely add to his troubles by starting dyspepsia, if not putrefaction, in his digestive organs, and presently he may vomit all the fresh supplies almost untouched by digestion.

To get this man once more into a condition to proceed may be a matter of hours, possibly days, and the first thing to do is to clear the uric acid out of the blood, and if this can be done, and as soon as it is done, there will be a rise of urea and a return of power without any fresh food having been given; this further illustrating the points already mentioned in reference to figs. 4 and 5.

Now the best way to clear the blood of uric acid is, as we see from the above figures, to give acids, acid wines, acid fruits, in fact acid in any form most likely to be absorbed from the stomach; or calomel or other metals that form insoluble compounds with uric acid, as pointed out in previous writings; but as the whole object of this book is to show that with proper care in selecting our sources of albumen this fatigue from uric acid collæmia and the obstructed

circulation it produces need not occur, I shall not here go further into the treatment of the condition by means of acids and drugs.

But while speaking of this, I will again point out that though the albuminous foods are those that really control the situation, other foods may have effects which may easily appear to others to be of more importance than they really are.

Thus though in fig. 4 the effect of 1 oz. of sugar is very small compared with that of 1 oz. of cheese, any one who had taken the sugar would say that they felt distinctly stronger and better for it; and so they would be, while acidity and urea were rising, partly because some albumen was indirectly rendered available for force production, and partly because the amount of uric acid in the blood was diminished and the circulation improved.

But this would equally be the case if the rise of acidity was produced by an acid containing no food elements whatever (see fig. 5); so that while I do not say that carbohydrates, oils and fats, have no effect on nutrition, and am not discussing their effects on the production of force in other forms, such as heat, I do say that their effect on the production of force and activity, and the excretion of urea is slight and indirect, and may for the present be neglected, with the object of making clearer and more useful our knowledge of the effects of the albumens.

And in so far as I propose to point out that those who are free from great excess of uric acid in the blood are also free from the above-described more severe and intractable form of fatigue, I must at the same time not forget to mention that the difference between those who suffer and those who do not suffer, is one of degree only, and that all have some uric acid in the blood, and are similarly influenced by acids and other drugs which clear it out of the circulation.

In those who have no available excess of uric acid in the body and blood, an acid, or an acid-forming food introduced into the stomach will at once be absorbed and clear out any uric acid there may be in the blood; but in those who are full of uric acid from head to foot, digestion and absorption are as much upset by the large quantity of uric acid in the blood, as is muscular circulation, skin circulation and general metabolism, and then the condition is difficult or impossible to cure, as food and drugs introduced into the stomach may quite fail to be absorbed; uric acid collæmia is a curable condition in the one case, but more or less incurable in the other, at least for a time.

I have also pointed out in "Uric Acid," that by watching urea excretion during exercise it is possible to tell at once whether fatigue is coming early, and whether that fatigue is due to excess of uric acid; for while exercise generally causes, as we have seen,

a rise of urea; if there is much uric acid in the blood, the beginning of the exercise will lead to a fall of urea in place of a rise, and then more or less severe fatigue soon comes on.

Now this fatigue can be prevented, as I am going to show, by means of suitable diet providing the necessary albumens, without the unnecessary uric acid, and it can, as already pointed out in "Uric Acid," be prevented by previously clearing out all the available uric acid; as by a course of salicylate left off on the day of exercise, or by giving acids, mercury, &c., to temporarily clear the blood at the time of exercise; in fact, it matters not how you clear the blood of uric acid, so long as you do clear it, and keep it clear during the exercise.

It has also been pointed out that exercise brings excess of uric acid into the blood by causing the elimination of acids in perspiration; thus diminishing the acidity of the urine and increasing the alkalinity of the blood and thus rendering it a better solvent of uric acid, and bringing uric acid into it when available from all directions.

In a word, exercise acts like a dose of alkali, and reverses the effects which we have seen to be produced by acids, hence in those who have plenty of available uric acid, heat and fatigue are contemporaneous, and almost synonymous; but in those who are free from excess of uric acid, heat and perspiration have little or no effect.

Hence the records we are now getting from all sides show that the less animal flesh a people take the better do they come out in trials of force production, and especially in endurance. As regards force production, those having equivalent quantities of albumen available from any source, animal or vegetable, will be equal to each other: but in endurance those will do best who get their albumens from such animal and vegetable sources as are practically free from uric acid, and who do not indulge in such stimulant poisons as tea, coffee, and other similar alkaloid-containing substances.

Now so far as I know the "vegetarians" of this country are pretty decidedly superior in endurance to those who feed on animal tissues, and might otherwise be expected to equal them; but these "vegetarians" would be better still, as I have for some years been pointing out, if they not only ruled out animal flesh, but also eggs, and the pulses (peas, beans and lentils) which contain a large amount of uric acid, or substances physiologically equivalent to it; also tea, coffee, and cocoa.

It also follows absolutely from what I have said, that meat is a stimulant because of the acid salts it contains, for uric acid itself is a stimulant, as may be demonstrated for anyone who will swallow a few grains of it, and it is the chief stimulant in beef-tea soups and meat extracts, and other deadly decoctions of flesh. Meat also contains a supply

of easily digested albumens, and the effect of swallowing animal flesh is that digestion is stimulated and circulation improved by the acids and acid salts, the albumens are quickly digested and rendered available, and as the result of these two causes, the happy owner of a portion of flesh is sooner in a position to evolve large quantities of force than the man who gets his albumen—perhaps exactly the same in amount—from a less stimulating source.

But there is another side to this picture, for in so far as this effect of flesh is due to stimulation, that stimulation will come to an end, just as we see in fig. 5 that the rise of urea after an acid comes to an end and is followed by a fall which is rapid and decided, and as the albumens of flesh are thus rapidly available, it follows that other things, such as quantity being equal, the albumens provided from flesh are more quickly available, but also more quickly worked off and dissipated, than those having a less stimulating origin in cheese or vegetables; though a somewhat similar effect can be produced by eating acid fruits and vegetables along with cheese, milk, &c.

It follows from this that a meal of meat, as compared with a meal of say milk, cheese and bread, equally rich in albumens, is like the force in an explosive oil, as compared with the same amount of force in a slow burning oil.

And the man who has dined on flesh, though possibly more lively and energetic at first, will find himself at the end, both of his stimulation and his available albumens and faced by rapidly falling urea and increasing fatigue, some time before his opponent, who got a precisely similar allowance of albumen from other sources.

Stimulation is not strength, but force rendered a little more quickly available; and it is always followed (and must be so) by an exactly corresponding amount of depression, when the force used up is not available, and has to be replaced.

The man also who had the meat and had his blood temporarily cleared of uric acid as the result of its acid stimulation, has not got rid of that uric acid; but it is waiting in his body and will return in increased quantity into his blood as soon as the rise of acidity and stimulation comes to an end; hence this man may, some time before his next meal, have an excess of uric acid in his blood and suffer from fatigue as a result of this also, while his milk, cheese and bread eating opponent, having less uric acid to return into his blood, will escape.

I think that this action of meat as a stimulant and producer of quickly worked off force has a good deal to say to the fact that, as we have come to eat more and more meat we have also come to have a larger and larger number of meals in the day; and now while the bread, cheese and vegetable feeder can do

well on two, or at most three, meals a day, the flesh feeders often take four, or perhaps five.

It follows also, that quite an exaggerated and erroneous estimate has been formed of the power of meat to produce force, because its stimulating effect has been mistaken for power, and the depression which follows has either been over-looked, which is possible at first, or later, has been counteracted by alcohol, tobacco and other more harmful stimulants; but the man who gets his albumens from a less stimulating source, having no early stimulation, has also no subsequent depression, and so probably never feels the want of any alcohol at all.

Hence it comes about that those who took alcohol on a flesh diet generally very soon give it up when they give up flesh, and smoke also very little, having no craving for any stimulant; while if what most meat-eaters say was true, that meat is very much better nourishment and more supporting than milk, bread, cheese, fruit and vegetables, it ought to be exactly the other way, and those who live on the latter foods should require to take alcohol, and be unable to do without it.

Another very common effect of meat eating, whether alcohol is added to it or not, is a certain amount of dulness, heaviness and disinclination for mental or bodily exertion in the morning hours, often associated with more or less irritability and mental depression.

In fact the meat eater is never quite himself or to be seen at his best till the evening, when rising acidity clears his blood for a time from excess of uric acid; and this is, I think, at least one of the factors that has caused our morning and evening hours to grow progressively later and later, as we have come to live more in towns, and eat more meat.

It is misery to rise in the morning hours if you feel dull, depressed, and unrefreshed; it is a pleasure to prolong the evening conviviality when you feel bright, and by contrast even cheerful. Few or none realise that a multitude of such minor sorrows are the direct results of their habits of life.

We see then, that there are two forms of fatigue, one due to absence of albumens from the blood, because albuminous foods are deficient, and one due to absence of albumens from the muscular tissues because, though present in the blood, the blood is unable to get to the tissues; both forms of fatigue are really due to the defective supply of albumens to the tissues, but the latter kind is complicated by the additional source of weakness that the circulation being defective, waste products are not removed from the tissues, but remain to further hinder their function and nutrition.

Thus in the walking race to be mentioned further on, in which the vegetarians are said to have walked the meat-eaters off their legs, food was

open to and partaken of by both alike: but the meat-eaters had impure blood so that they could neither digest the albumens, nor get them to their tissues when digested; and so they failed not from defective supply but from obstructed circulation. Further, the vegetable-feeders came in fresh and in good condition, and the winner asserted that he could have gone faster if necessary; but the only meat-eater who came in at all required brandy to revive him.

We have also seen that by means of diet it is possible to prevent completely the latter form of fatigue, leaving the individual who thus controls his diet liable only to that form of fatigue which is due to deficient albumen, from deficient or irregular food supplies.

I have for years been pointing out in "Uric Acid" that other things, such as nutrition and the supply of albumens being equal, I can absolutely control the incidence of fatigue by controlling the uric acid, that I can prevent fatigue for many hours, in spite of great heat and exertion, either by sweeping out beforehand most of the available uric acid by means of a solvent such as a salicylate, or by clearing the blood directly by means of drugs such as acids, opium or mercury, which clear the blood of uric acid by interfering with its solubility, which is the way in which meat acts as a stimulant. I have also pointed out that these methods have been used

probably for thousands and thousands of years by those who had no exact knowledge of their mode of action, as opium for fatigue of men and horses in India, and lemons, &c., by athletes on this side of the world, and I have come across several individuals who had similarly made use of mercury, or more recently of salicylates, for their effects on their mental or bodily powers. I have also pointed out that exactly the same effects can be produced by clearing the blood of uric acid by means of diet and have said that in my own case while on ordinary flesh diet I might often be placed *hors de combat* in half an hour or an hour by exposure to heat and exertion; on a uric acid free diet, I can confidently reckon on being able to produce large amounts of force for at least three or four hours, in spite of any heat that we meet with in this country; and have pointed out that abstainers from flesh all over the world have had similar experiences, and not infrequently get the better of flesh-eating opponents from this cause.

I have pointed out that the fatigue which is produced by a rush of uric acid into the blood is accompanied by an immediate fall of urea, while exercise without such uric acid in the blood and without fatigue, is accompanied by an immediate rise of urea; and no doubt it would thus be quite easy to tell from the urea excretion of two athletic competitors, which was going to fail first.

In myself also the rise and fall of urea as shown in the previous figures, is most accurately represented in one's feelings of strength or of weakness; so that over and over again it has occurred to me in making these and similar curves, to write down my feelings at the time and to find afterwards, when the urine had been collected and estimated and the urea worked out, that these feelings had quite accurately represented the changes taking place in the excretion of urea, and anyone who will note his own feelings during such a change in the excretion of urea as is shown in fig. 1 from 1.0 p.m. to 3.0 p.m., will have no difficulty in understanding this.

I have now also no doubt that the severe collapse and asthenia, that follows on attacks of gastric dyspepsia or gastritis from any cause is due to a stoppage of the digestion and absorption of albumens, producing a corresponding fall in the production of force and urea, and the latter would be found in all such cases, if the urine was collected and examined.

Similarly any injury to any part of the body which suffices to cause serious interference with gastric digestion will produce similar asthenia and fall of urea, and it follows also from our first principles, that in flesh-eaters such fall of urea will be the signal for a rush of uric acid into the blood, and this will still further hamper and impede digestion, circulation and nutrition in all directions, giving

rise to the more serious and fatal complications of shock.

It follows from this, also, that abstainers from flesh and tea will have, as compared with flesh-eaters and tea-drinkers, a certain relative immunity from shock after injury, and its more severe and fatal results; and this is, I think, as shown by cases quoted in "Uric Acid" (pp. 303 and 639), matter of common observation.

It seems, then, that there is overwhelming evidence to prove that fatigue or its absence is simply a matter of the adequate supply of albumen to the muscles, and that this in turn is controlled by two factors (1) a satisfactory and sufficient supply of albumens in the blood, and (2) a free circulation of this blood through the tissues to furnish the albumen as required, and remove waste products.

We see also that diet places both these factors under our control, and that the excretion of urea is a reliable guide to the results it produces.

CHAPTER III.

Foods Available: their Properties and Relative Importance.

The foods available are so numerous that we must first of all divide them into classes and consider them in a general way.

These classes have one thing in common, that they contain no uric acid, or very little indeed compared with animal flesh and eggs, or vegetable substances rich in alkaloids, such as tea, coffee and cocoa, which are, for the reasons given in previous chapters, to be excluded

The uric acid free foods fall then into the following classes or groups:—

(1) Milk and milk products, as cheese and "protene."

(2) Bread stuffs, cereal foods and glutens.

(3) Nuts and nut foods.

(4) Garden vegetables, as potatoes.

(5) Garden fruits, as apples.

(6) Dried and foreign fruits.

Milk is one of the best of these available foods, because it is easy and quick of digestion, and affords,

; seen in fig. 2, a supply of albumens and
; and urea, in a comparatively short space

,' people believe that they cannot take milk,
iere are undoubtedly a good many things in
ry diet with which it does not go very well,
h, beer, wine and tobacco; but then the folly
taking these things at all, not in taking the
K and leaving them out.

Some believe that they cannot digest milk, but nis again generally resolves itself into taking it with improper foods, in improper quantities, or at improper times; people who, when they have already swallowed a good and sufficient meal of other things, take down a tumbler or more of milk on top of them, are very likely to have some digestive trouble.

Those also who taking three or four good meals a day, take a tumbler of milk between times just to keep up their strength, are much more likely to tire out their wretched gastric digestion and get dyspepsia and debility as a result; but all this cannot be justly charged to the milk, but to the foolish way in which it is taken.

When milk is treated sensibly as a most important food deserves to be, and taken at one or two of the three daily meals and generally broken up and distributed among the rest of the foods, such as bread, and cereals, vegetables and fruits, it is, in the great

majority of cases, easily and painlessly dig.
furnishes its proper quantum of albumens, .
urea.

Very much the same applies to cheese, and character it frequently bears is much more oft. to the way in which it is taken at the end of a already too heavy; or in too large quantity, insufficiently broken up, rather than to any of own good or bad qualities.

Cheese contains more albumen than any other the common foods, and should be taken early in the meal and well distributed through bread stuffs or vegetables; it should be well broken up and masticated, and if hard and the teeth are bad, it should be grated before use.

Those living on a mixed diet rarely require to take more than 2 or 3 ozs. of cheese in a day, that is 1 or 1½ ozs. at two meals, and I have never met any one who could not take this quantity easily and digest it well, when going the right way to work.

Protene is a patent substance prepared from milk by Protene, Limited, 36, Welbeck Street, W. It is said to be almost pure albumen, and my experiments seem to confirm this statement.

It is specially useful in conditions where the fat or sugar of milk is not required, and I shall have to mention it again in relation to diet for special conditions; but otherwise its digestion and use is much the same as that of milk or cheese, and it may be

as containing about 2·6 times as much as its own weight of cheese.

be obtained in the form of a powder which mixed with various other foods, to increase, essary, their albumen values; it is also factured into bread, gingerbread, and biscuits, ch are convenient and palatable.

read stuffs and cereal foods are often the most portant items in the diet list: containing much ss albumen than cheese, they are eaten in much arger quantity, and generally form the backbone of the mixed diets, often contributing one half or more of the day's allowance of albumens.

A larger volume than this would scarcely suffice to enumerate their kinds, qualities and preparations, and I must here content myself with saying that they appear to me, especially in the form of bread or biscuit, to furnish a steady and equable supply of albumens over a number of hours, and thus to increase the powers of endurance of those who make use of them, being in this respect at the opposite pole of nutrition from milk or meat.

They often contain a considerable quantity of acid or acid salts, and thus tend rather to keep up the acidity of the urine, and may in conjunction with other things, as acid fruits, lead to some retention of uric acid, especially if aided by the cold weather of winter.

Biscuit is a form of bread stuff which has some

advantages, for being dry it not only cont
nourishment in the same weight, but it
somewhat better cooked than bread; and b
is an advantage as regards digestibility, as it
the digestive juices of the mouth to penet
more easily.

Thus saliva will penetrate more easily into
biscuit or toast, less easily into bread, still less ea
into new moist bread, and only with great difficu
slowly, and after considerable dilution, into bread
biscuit soaked or sodden with water or milk.

I quite agree also with Dr. Kellogg and those of his school, who teach the great importance of the complete and thorough cooking of cereal foods,[1] and the use of such foods is often an additional help in severe dyspepsia: but I find that many people can take ordinary biscuits and cereal foods if they are careful to take them dry (a point also insisted on by Dr. Kellogg), and that the complete penetration of the saliva into such foods thus insured, will in many people, make all the difference between flatulent dyspepsia and satisfactory and painless digestion of cereals: but I shall have to mention this subject again in connection with the common causes of dyspepsia (see chap. iv.).

Rice, the staple food of many Eastern Countries

[1] Super-cooked cereal foods as advised by Dr. Kellogg can be obtained from "The London Health Food Co.," 451, Holloway Road, London, N.

important cereal and we in this country
ɔably neither treated it properly, nor appre-
, at its true value.

ɘ nations that live on it are careful to get
.ce, to cook it thoroughly, and to have it as dry
ssible at the end of the cooking: with this
·t they steam it rather than boil it, or if water
dded to the rice it is all boiled away, as any
ter poured away after cooking would carry
ɔurishment with it.

I have been told also, that much of the rice sent to this country is not that which is considered the best by the natives of the countries where it is grown, and one can quite understand that it is useless to send the best rice to countries where it is not appreciated.

Gluten is the albumen of bread or flour, and this can be added to bread, to puddings, or other cereals to increase, if need be, their albumen values; it may also be used by itself in various forms, where the starch of cereals is not wanted.

Nuts and nut foods are valuable, because fairly rich in albumens; but they have the disadvantage of requiring good sound teeth, well used, or they are apt to be indigestible. They often contain a considerable quantity of oil, and many biscuits and foods prepared from them do not keep well owing to changes in this oil.[1]

---

[1] Protene, Limited, supply some nut foods and gluten in convenient forms, also aleuronat obtained from wheat, which may be useful.

Nevertheless nuts are by no means to be neglected; they form a large item in the diet of many nations and with some they more or less completely take the place of bread.

This is specially the case with chestnuts, which when well cooked are easily digested by almost everyone, and other nuts can be passed through a nut-mill to aid the teeth if defective.

Those, who for one reason or another do not like milk or cheese, should remember that from 1 pound of bread, or bread stuffs of equal value, and a few ounces of nuts, they may get nearly three-quarters of the albumens they require for a day, so that in this way they may get on with very little milk or cheese, or even entirely without them.

Garden vegetables, as potatoes—here again I am obliged to mention only one or two kinds and some special points. Speaking generally, garden vegetables contain only very little albumen, and are of use rather to supply bulk, and to dilute and break up the more albuminous foods, such as milk and cheese, than for their albumens.

Potatoes, in addition to somewhat less than 2 per cent. of albumens, contribute a considerable quantity of alkali, which is often useful to keep down the acidity of the urine and prevent retention of uric acid by other foods, some of which have been mentioned above as contributing some excess of acids.

For this reason eating a moderate quantity of

potatoes twice a day may suffice to make a urine which tends to throw out a little red sand from time to time, owing to relatively high acidity, cease to do so; and those who suffer in this way from eating acid fruits should counteract their effects by taking a corresponding quantity of potatoes.

Garden fruits—here again I must pass over whole classes with a word. Most of our fruits contain only a fraction of 1 per cent. of albumens, and are for the most part equivalent to water with some sugar and salts, and these salts, as a rule, may be considered as alkalies, for though they are often present in the form of acid tartrate of potash, which reddens litmus and acts as an acid when first swallowed, their effect on the blood and urine of a whole day is that of an alkali, diminishing the acidity of the urine and probably increasing the alkalinity of the blood (see "Uric Acid," p. 527).

Many acid fruits, however, act as acids, at least for the first few hours after they are swallowed, and thus stimulate—in the way previously explained in reference to fig. 5—nutrition, digestion and the production of force and urea.

And almost everyone, I suppose, who has gone in for athletics knows the reviving effect of a mouthful of lemon, which is no doubt due to its action as an acid, but even lemon has little or no effect on the acidity of twenty-four hours' urine.

Still, acid fruits taken in any considerable quantity

with breakfast, and unbalanced by potatoes, do influence very decidedly the large morning excretion of uric acid, and so diminish the excretion of that substance for the whole day.

Garden fruits generally may be regarded as increasing the bulk of the day's food without adding much to its albumen values; but they contribute a valuable supply of water, some sugar and some useful salts.

Still, taking the fruit of an ordinary day and after deducting stones, skins and stalks, in fact weighing only the parts eaten, one would probably not be far wrong if one reckoned them as containing about two per cent. of albumens.

Dried and foreign fruits are in their original condition very similar to those above considered, but when a large part of their water has been removed by drying, their relative albumen value is of course greatly increased, and such things as figs, dates and various kinds of plums, when eaten in considerable quantity, make a quite appreciable addition to the day's albumens, and those of them that contain acids or acid salts, also act more powerfully as acids when condensed by drying.

Looking at all these groups of foods, I will conclude this part of the subject by saying that it is possible to live on a diet which includes some of each of these groups in its daily routine; that it is possible to live on group (1), milk and its products

alone; that it is also possible to live on all the rest, excluding milk and animal products entirely, and relying chiefly on (2) and (3), cereals, and nuts for the necessary albumens; that it is not possible to live on (4) and (5), garden vegetables and fruits alone, and generally in this country not on (6), dried fruits alone.

As the result of my own personal experiences, I incline to believe that a diet which includes all or nearly all of these groups in its day's cycle, is the best, the contribution from each group being varied from day to day to an almost endless extent, just as flesh-eaters vary the quantity, quality and mode of preparation of their animal food from day to day.

CHAPTER IV.

Values of Foods in Albumen and Urea. Quantities Required. Diet of Training and Athletics.

In considering the values of foods and the quantities required, and in apportioning these into special diets, it will be convenient to treat of diets according as they are required for ordinary conditions of life, for special training and exercise, or for the treatment of slight departures from normal health, such as obesity and some minor alterations of function.

We have already seen in chapter i. that the body weight in pounds, multiplied by 9, gives the amount of albumens required for a sedentary life, and by 10·5 those required for an active life, such as that of an out-door labourer.

And if we take an active man of 140 lbs., and apply these rules, we find that he will require 1,470 grains of albumen per day, which will produce 490 grains of urea per day when completely digested and metabolised.

With regard to urea, I may say that the percentages of albumen values to be given in the diet tables that follow, have been found by me from practical trial to be very close to the truth; for though on a weighed diet, continued from day to day, urea will be one day below and another above the quantity calculated from the albumen values of those foods, when taken over days or weeks, these fluctuations tend to balance each other, and over such a period the urea calculated from the albumens generally comes very close indeed to the urea found.

These fluctuations no doubt arise from variations in the time of digestion of the foods used, as the digestion and absorption of a food taken one day is not necessarily concluded in time for the twenty-four hours' division of the urine; and then, again, when albumens have been absorbed, they may, as we have seen reason to believe, remain either in the blood or the tissues as a reserve of force till a special call for force production and activity is made. (See fig. 1 and remarks upon it; also "Uric Acid," p. 280.)

But when allowance is made for these causes of variation, the values to be given are, I believe, quite sufficiently accurate for our practical purposes.

Now the albumens required for this man of 140 lbs. can be got from

Table I.

10 ozs. of bread	8	per cent.	of albumens	=	340 grs.
2 ozs. of oatmeal	12	,,	,,	=	104 ,,
2 pints of milk	3	,,	,,	=	525 ,,
2 ozs. of cheese	33	,,	,,	=	281 ,,
1 oz. of nuts	16	,,	,,	=	68 ,,
18 ozs. fruit and vegetables, say ½ to 2		,,	,,	=	152 ,,
					1,470

Now it is obvious that such a diet list may be varied greatly in very many directions, and that such variations may be used as temporary changes or permanent diets according to taste, habits, cost, facility for preparation, and other concomitant conditions.

For those who do not do well on or like much fluid, the milk can be reduced to 1 pint per day if the cheese is increased to 4 oz.; others again may be able to increase bread or bread stuffs to 16 ozs., which would just about enable them to reduce the milk to 1 pint or cut out the cheese entirely.

Those who do not like or cannot digest nuts in any form or of any kind, may leave them out, slightly increasing the bread, milk or cheese, or replacing them by about three times their quantity (3 oz.) of dried fruit.

I will just mention that almonds are to be obtained at all times, that well roasted and salted they are generally liked, and that for those whose

teeth are not of the best they may be passed through a nut mill.

Nuts have the further advantage common to many substances that leave undigested residues of tending to prevent or relieve constipation; in other people, however, they again, in common with other undigested particles, may cause some intestinal irritation, which may give rise to papular and other slight skin eruptions.

Then again the total bulk of the diet may be greatly diminished by substituting gluten or protene for some of the bread; or by adding gluten to some of the bread or cereal foods, or by taking a bread such as Hovis, which contains a larger percentage of albumens than ordinary bread, thus :—

TABLE II.

5 ozs. Hovis bread[1]	16	per cent. of albumens		= 340	grs.
2 ozs. oatmeal	12	,,	,,	= 104	,,
1 oz. gluten	80	,,	,,	= 344	,,
1 pint milk	3	,,	,,	= 262	,,
3 ozs. cheese	33	,,	,,	= 421	,,
				1,471	

A further modification of such a diet, and one that is sometimes convenient if only because it entails almost no labour for preparation and cooking, is one consisting of milk and cheese, fruit and vegetables, thus :—

[1] While most of the above percentages of albumens are from Parkes' "Practical Hygiene," 5th ed., with which my researches agree, the value of Hovis and of nuts is that calculated from my researches alone.

TABLE III.

3 ozs. cheese	33 per cent. of albumens	=	421 grs.
3 pints milk	3 ,, ,,	=	787 ,,
14 ozs. potatoes	2 ,, ,,	=	120 ,,
16 ozs. fruit	2 ,, ,,	=	137 ,,
			1,465

I may say that I took the above diet of cheese, milk, potatoes, and fruit for four or five months with very good results, and should recommend it for those who suffer from dyspepsia, with cereal foods and bread, or as a change from these. It is convenient for those who desire for a time, either at home or while travelling, to be almost independent of cooking, as except for the potatoes and occasionally a little stewed fruit, almost no cooking is required, and raw fresh fruit can be substituted for potatoes if necessary.

It is also a diet that does pretty well for children, who are often fond of fruit and vegetables, and as these would only rarely require more than some 1,200 grains of albumen, the cheese could be reduced to 2 ozs. or less in their case.

Some may be able to take more than the above quantities of potatoes and fruit, and then the milk may be somewhat reduced, as 3 pints is rather a large quantity of fluid, especially in cold weather and for those who are sedentary.

My own experience is, that I can take 2½ or even 3 pints of milk quite well in summer, especially if

not sedentary; but 2 pints are quite enough in winter and when sedentary.

Others, again, may be able to take more than 3 ozs. of cheese and can reduce the milk while increasing the cheese; and those who get on well with nuts or dried fruits can considerably reduce either cheese or milk, replacing them by one or both of these as mentioned with regard to Table I.

Such are some of the chief modifications of the diet, but it is obvious that it can be altered in an almost endless variety of ways, and those to whom few foods come amiss, and who have good digestion, can have a different diet, or at least a considerable change of food every week throughout the year.

There are some people, however, who do not take kindly to any of these foods and who are in a very poor way, feeble and dyspeptic; with these any of the above modifications of diet may be difficult, and for a time even impossible.

They cannot drink milk, or they greatly dislike it; they cannot digest cheese, and they can eat but little bread, and so on through the whole list; there is practically nothing but meat, fish and eggs which they can eat, and they have but a poor appetite even for these.

With these people it is best, I think, to improve the general health, and get up an appetite by tonics and change of air before altering the food at all; and

the meals, if too frequent, may be spaced and reduced to three, two, or even one in the day.

Or in some cases food may be altogether withheld for some days till there is a decided appetite, as recommended by Dr. Dewey (previous reference), and then when there is a good appetite for ordinary food, some of the flesh food of the old diet may be gradually replaced by equivalent value in milk, cheese, or bread; thus one meal at a time may be changed, with more or less interval between the changes as may be required.

But to put a debilitated and dyspeptic patient suddenly on to a diet which is not relished, and may not be digested is, I think, at best rash, and may even be somewhat dangerous.

I believe that with care, patience, and determination these initial difficulties can generally be overcome, especially when the fear of serious or painful disease furnishes some *vis a tergo*.

But even in those who get over these initial difficulties, dyspepsia may now and then cause some more or less decided trouble, and I shall, therefore, mention shortly what have appeared to me to be the chief causes of this.

Too much albumen especially in the form of milk and cheese to which the patient is not accustomed. Bread is a better and more reliable food, and its bulk generally prevents its being taken in too large a quantity.

Too great bulk of food (fruit and vegetables) especially in those accustomed to such foods of small bulk as meat, fish and eggs.

For this trouble food may be reduced, at least for a time, to little besides milk, cheese and bread stuffs, the more nourishing and important foods; and vegetables and fruit should be taken only after these have been provided for, and in quite small quantities.

Too much fluid. It should, I think, be a rule with all who go on to these diets never to drink when not thirsty, for those who do so tend to get a dilute and watery condition of the blood, and this entails a more or less dilute and watery condition of the digestive secretions poured out from the blood.

Such dilute digestive secretions will act slowly and inefficiently, and more or less fermentation and putrefaction will, meanwhile, be going on in the food masses, resulting in the formation of gases, acids, and decomposition products.

Too much sloppy and pultaceous food, especially starchy food. This, I have already referred to, and pointed out the importance of taking starchy foods as dry as possible, for if such foods are sodden with fluid, the salivary digestive secretion obviously cannot very easily get into contact with its starchy particles, or can only do so slowly and after more or less dilution.

And it is certainly a fact that, under some condi-

tions, the stopping of bread and milk, porridge, and milky puddings, and their replacement by toast, biscuits and oatcake, eaten dry or with a little butter, the milk being taken only apart or after them, may make all the difference between troublesome flatulent dyspepsia, distension and discomfort, and their absence.

And it is for these reasons (fear of too much fluid in the blood or too much sloppy starchy food), that it is often advisable not to take more milk than two pints in the day, especially in cold weather, and when sedentary; and also not to mix that milk with starchy foods into slops and porridges and puddings; and those who suffer from flatulent dyspepsia should carefully bear these points in mind.

There is no harm in drinking when thirsty, for thirst means that the blood is concentrated and in want of fluid, and nature will not ask for more than she wants: but there may be great harm in taking fluid by rule, or order, and apart from thirst; and it may even make all the difference between success and failure with the diet.

Too frequent food. It is a remarkable fact that those who take meat require to be fed more frequently than those who live largely on cereals, and it is due, as already mentioned, to the fact that meat is a stimulant and is quickly digested, absorbed, and worked off, while cereal food is more slowly assimi-

lated, and gives off over a series of hours a constant steady supply of albumen force and urea.

But on giving up meat the frequent feeding need not be continued, and those who attempt to continue it will be more liable to dyspepsia than those who are content with two or, at most, three meals a day.

I frequently see people who take as many as six to seven meals in the twenty-four hours, that is to say, they take three or four chief meals and two or three intermediate meals of milk, &c., between these. They learned this habit on the old diet, and they continue it on the new, under the impression that they must eat and drink a great deal to keep their strength up; but the common result of their efforts is dyspepsia and debility.

Another cause of dyspepsia with milk may undoubtedly be the preservatives mixed with it. These may have but little influence when it is only taken in small quantity in tea, and yet may produce more or less serious effects in those who take it in the larger quantities advised in the tables of this book.

I have made some experiments with borax myself, and the utmost dose I could take even for a short time without producing symptoms of gastro-intestinal dyspepsia, was 30 grains in the day.

I should, therefore, advise those who can eliminate the other causes of dyspepsia, and yet find their

dyspepsia associated with milk or other foods with which preservatives are known to be mixed, to make a special effort to obtain these foods free from such preservatives, and see whether the symptoms then subside.

In all these diets, butter and oil may be freely taken with cereals and vegetables, they are merely left out of the Tables because they contain no albumen or nitrogen, but these and the starches are very amply provided for in the diets.

It is, I think, common experience that butter and oil can be much more freely taken on a meat free diet than on one containing flesh, and it is at least probable that the evil influence of uric acid in the blood, hindering, as it does, circulation, digestion, metabolism and combustion, has something to do with this; and certainly the digestive, hepatic, and other disturbances that accompany bilious attacks and sick headaches are due to the circulation effects of uric acid.

Though the action of these substances in the production of force is probably indirect, and for the most part unimportant, they are amply provided for in the diets, and the assimilation and metabolism of fat is distinctly facilitated, when it forms part of a uric acid free diet.

I may note in passing that the diet of milk, cheese, potatoes and fruit, is that which of all others seemed to best keep the urine clear and free

from deposits of urates or red sand, and this was no doubt due to the amount of alkali in the potatoes and of similar salts in the fruit, as well as to the absence from milk and cheese of salts such as those contained in meat and cereals, which tend to raise the acidity of the urine.

Thus I have pointed out in "Uric Acid" that the relation of the acid excreted in the urine to the urea excreted at the same time, is on a diet containing some fish and eggs, 1-6·3, *i.e.*, 1 grain of acid to 6·3 grains of urea. While on a diet such as that in Tables I. and II. it is 1-7, or between 1-7 and 1-8, and on a diet such as that in Table III., it tends to be about 1-9 or between 1-9 and 1-10, and with this the urine is generally quite clear.

It will be understood from what I have said in "Uric Acid," that this is not so much a matter of the quantity of uric acid excreted as of its solubility in the urine after excretion: though no doubt both are affected by acidity, and a deposit of red sand in the urine is the index of deficient, rather than (as is so commonly supposed) of excessive excretion, from the body.

But it may be of some interest to those who are worried about such deposits in the urine of their patients, to know that by such a diet as the above, which diminishes the relative acidity of the urine, they can be prevented. Those also who are very sedentary should be careful, especially in cold

weather, to take no more albumens than are really required for strength and nutrition, as acidity rises with urea, and under these conditions it may suffice if body weight is × by 8 in place of 9. With reference to the relatively high acidity of the urine with the diets in Tables I. and II., I think that some part of this must be credited to the bread and cereal foods which are well represented in these Tables, but are completely absent in Table III., and if we look at the anlaysis of a cereal, such as barley, we find that it appears to contain a considerable excess of acids.

Thus I see[1] that the ash of barley contains 34·9 per cent. of potash, soda, lime and magnesia, and 61·6 per cent. of phosphoric, sulphuric, and soluble silicic acids, and if wheat and oats have any similar excess this will easily account for the relatively high acidity of the urine on the diets of which they form a part.

These cereals often tend markedly to raise the acidity of the urine, and when taken in quantity over a length of time, and especially in cold weather, they may not only raise the acidity of the urine, but also diminish the alkalinity of the blood, hence they may tend to cause some retention of uric acid in the body, and acting with other causes may even lead towards gout and rheumatism.

---

[1] In a text book of the "Science of Brewing," Moritz and Morris. 1891. P. 75.

Thus horses suffer considerably from rheumatism, probably when given too much dry cereal and too little fresh vegetable, and they are very often greatly exposed to cold and wet, all causes which tend to diminish the alkalinity of the blood.

With reference to pulses, it will have been noticed that they are not now mentioned either here or in the tables of foods, and this is due to the fact (of which I shall give full details in the further publication of my experimental work elsewhere), that I have found out that they actually contain even more xanthin than many kinds of animal flesh, and are therefore like flesh and alkaloid containing vegetable substances, to be regarded as poisonous.

I should now, therefore, be inclined to consider that the rheumatism met with among the vegetarian natives of India is not so much due, as I previously suggested, to excess of cereals with deficiency of fresh fruits and vegetables, exposure to cold at nights, &c., as in the case of horses, though no doubt all these things have some contributory effects; but rather to direct and considerable introduction of uric acid or xanthin in the pulse foods, which so many of them use to a large extent.

And I believe it will turn out, on investigation, that in those parts of India, where rice and fresh vegetable substances form the staple foods, not only rheumatism but uric acid diseases generally are but little known, while in those parts where pulses are

very largely consumed, they are common—almost universal.

A similar investigation in Australia and New Zealand would, I believe, trace to the excessive use of flesh and tea an equally long array of serious or deadly diseases, and an almost equal number of mental and moral defects, which only a complete reversal of their present diet habits will render visible by contrast.

In this country also I should attribute to the poisons of flesh and tea the all-pervading anæmia which, as seen in London, cannot be due to want of oxygen, as I have pointed out that it is equally to be seen in country towns of only half a mile radius; and many mental and moral obliquities are no doubt due to the obstructed circulation of poor and poison-laden blood (see "Uric Acid," pp. 417 and 642).

But these diseases have crept over us so gradually that we quite fail to recognise the full extent of our loss; and even in my own case I should formerly have said that, apart from headaches, I had good mental and bodily health on meat and tea, because I knew no better; but I should now say that I have in both directions 50 per cent. better health without them.

For the benefit of some who may see mountains of difficulty in minute points, I will now give an outline of a day's food on the above diet.

For those in good health three meals a day, breakfast, lunch and dinner are ample, some even do better with a light breakfast or none—this latter course being specially indicated where there is little or no appetite for a morning meal (see Dr. Dewey's works referred to in chapter i.)

I may say also that simple food of not more than two or three kinds at one meal is another great secret of health; and if this seems harsh to those whose day is at present divided between contemplating and preparing their food, and eating it, I am afraid I must be still more unkind and ask them to consider seriously whether such a life is not the acme of selfish meanness.

And in case they should ever be at a loss what to do with the time thus saved from feasting and preparing to feast, I would point on the one hand to the mass of unrelieved destitution, ignorance, sorrow and suffering, and on the other to the doors of literature, science and art, which stand ever open to those fortunate enough to have time to investigate them; and from none of these, as they are still in their infancy, need any turn aside from want of new kingdoms to conquer.

In any case the best of health, strength and nutrition are not to be obtained by waste of time and money on elaborate food, when the simplest things are all that are really required and accepted by nature.

If we take then, Table I., breakfast (before which

an hour or an hour and a half's work if possible in the fresh air, is no drawback) may well consist of oatmeal (2 ozs.) cooked in the form of porridge, with ½-¾ or 1 pint of milk, and this may be followed by some toast or bread (2-3 ozs.) and butter, with marmalade or jam. These are the staple foods of the breakfast and should be taken first, and if when they have been consumed, some appetite still remains, any fresh fruit, or dried fruit in winter, may be taken to any desired extent.

I should say, however, that those who are specially anxious to have a free excretion of uric acid, and not to retain any of this substance in their body, should not take much acid fruit at breakfast, or should divide their attention between such acid fruits and potatoes which contain much alkali, so that the alkali may more or less balance the acid.

For those who have not to be specially anxious about excretion, and who do not suffer from any active gout or rheumatism, fruit at breakfast is probably not hurtful, and acts as a slight tonic and stimulant.

As variations of this diet, bread and milk may be substituted for porridge, the oatmeal may be taken as oatcakes, and scones, or any other cereal of equivalent nutrition value, and quantity, may be substituted for it in any desired form; so that it may be possible to have a new kind of cereal every morning of the week, or even every morning of the month.

These are all homely foods, to be found in nearly every household or nearly every baker's shop, and their cooking, therefore, presents no insuperable difficulties.[1]

As to fruits in winter, apples, oranges, bananas, figs, dates and various kinds of plums, generally afford sufficient variety, and in summer and autumn there are endless fresh fruits to take their place; and though as is seen in the Tables, many fruits and vegetables have but little direct value as nourishment, a moderate daily supply of these things conduces in many ways to the attainment of the best health, strength and nutrition. On the other hand the foods to live upon are bread, milk, cheese, and nuts, and of these bread is the most reliable; and those who cannot take and digest a sufficient quantity of one of its almost endless varieties, are indeed unfortunate.

Lunch, which is often with advantage the best meal of the day, may begin with some vegetable soup made with milk; this may be like ordinary potato soup, the meat or bone boilings being simply replaced by milk, which is much more nourishing, or the same or similar preparation may be used with some of the other kinds of vegetable.

---

[1] Those who want a guide as to the quantity of each article, and also some hints as to cooking and preparation, will find much useful help in small compass in Mr. A. Broadbent's "Science in the Daily Meal," to be obtained from him at 19, Oxford Street, Manchester, price 2d.

Next course, potatoes, with milk, oil or butter and the cheese (2 oz.) taken with them.

Several ounces of bread, toast or biscuit should also be eaten with the soup and the potatoes and cheese: these forming the sauces to the bread stuffs.

A dish of rice, macaroni, barley, or other cereal may be substituted for the potatoes and part of the bread.

I may mention here that I look upon good olive oil as a valuable substitute for butter. It is specially nice with vegetables, and may be eaten with many of these, besides the salads for which it has so long been used.

It is of great use also in cooking vegetables, and many get to like it so much that they entirely give up the use of butter; others prefer it only now and again as a change from butter.

It is necessary to get it good and fresh, when it is free from all strong and objectionable taste.

These are the chief items of nourishment at lunch, and should be taken first as a first charge on the appetite; and care should be taken not to allow the less nourishing potatoes and garden vegetables to oust the more nourishing cheese, bread and cereals: the sauces must not encroach on the foods.

The following experience may illustrate what I mean: One autumn day a party of cyclists were out riding, and finding in the middle of the day that it

was extremely hot, and also that there were a large number of blackberries at the side of the road, they called a halt and spent half an hour in eating the fruit. This was about 12.30 or 1 p.m. and when it came to their ordinary lunch time, 2 p.m., none of them had much appetite as they were busy digesting the blackberries; the result was that but a poor lunch was made.

The blackberries, however, contained but very little albumen, the supply at lunch was deficient, and the result was that about 5 p.m. they were all short of albumens and force, and had to call a halt for more food to enable them to continue their ride, while as a rule, they required no food from the 2 p.m. meal till 8 or even 8.30 p.m. Now this is pretty much what is done by those who sit down to a meal and fill themselves with the lowly nourishing vegetables and fruits, leaving the bread, milk and cheese to the last; they have then but little appetite, and unless they eat by measure, do not take enough.

The rest of the meal may consist of milk pudding, tart, or stewed fruit (the pudding not, of course, containing any egg), the cereal in the pudding may make up for any deficiency in the oatmeal or cereal taken at breakfast; and last, the nuts with fresh or dried fruit to any required extent.[1]

[1] If nuts are taken in larger quantity than that mentioned in Table I. they should be given an earlier and more important place in the meal.

If the lunch is a good meal eaten with appetite, nothing but a drink of water, or ærated water with fruit juice in summer, will be required till 7.30 or 8 p.m., when all that remains of the milk and bread may be taken with some more potato or other vegetable, butter or oil being always allowed *ad lib.*, except to those who are too stout.

These may be followed by junket, or stewed fruit with cream (the latter being only equivalent to butter or oil, and the junket taking the place of some of the milk), and these again as usual by an unlimited supply of fresh fruits.

When a meal such as lunch has to be taken out of doors and away from home, the cheese may be made into sandwiches, either being cut in slices or grated for the purpose.

Similar sandwiches to be eaten with these, may be made with various vegetables, such as mustard and cress, lettuce, beetroot, cucumber or tomatoes.

In this way the chief ingredients of the lunch can be carried and some milk, ærated waters and fruit will complete it.

A similar lunch, which is quickly provided and easily carried, may consist entirely of some biscuits with more or less butter, some cheese and some fruit.

The milk, cheese, potatoes and fruit diet which, as before mentioned, has many and great advantages, would work out into meals as follows :—

Breakfast :—1 pint of milk,

Bananas, Apples, Pears, Plums, fresh or dried, or cooked, Any other fresh fruit	eaten with it to any extent for which there is appetite.

Lunch :—Vegetable soup made with milk.
Plate of potatoes (with butter, oil or milk).
2 ozs. cheese, eaten with potatoes and any other vegetables in season.
Stewed fruit or tart.
Fresh fruit.
1 pint of milk drunk during the meal.

Dinner :—Much as lunch.
1 pint of milk.
1 oz. cheese.

Any variety in vegetables and fruits in season; and of course if potatoes and fruit are liked and taken in larger quantity than is given in Table III., somewhat less milk and cheese will be required.

No extra drink of any sort is required, as the fresh fruit and the milk generally supply quite enough liquid. When away from home cheese can be carried in place of milk in the proportion of 2 ozs. cheese to 1 pint of milk.

What I shall have to say about stimulants, presently, of course applies to all alcoholic beverages, and milk, water, aereated waters and fruit juices are the best drinks; but cider, when made from the pure juice of fruit, has but little in it that need be objected to, and many nice drinks for hot weather can be made from lemons, apples, raspberries, &c.

Another point is, and this applies to drinks, fruit, vegetables, and all kinds of additional foods, that

nothing must be taken that interferes with digestion or upsets the stomach ; or digestion altogether may come to a standstill and there will be no rise of urea as in fig. 1 at 3 p.m., and no increased power of working and force production, no matter how nourishing and rich in albumens the foods previously taken may be.

Now very acid fruits, very tough or sour vegetables, a glass of raw spirits, or a strong pipe or cigar, or an ice after food, in those not accustomed to them may act in this way, and either cause nausea and the entire loss of the meal by vomiting ; or at least suspend digestion and the absorption of albumens and the production of force for some hours, more or less.

Thus, a boy of 13, out with a shooting party and having lunch with them, was given some whisky after it, with the result that he presently brought up his whole meal. By accident the wine had been forgotten, and as it was thought that the boy must have something other than pure water with his lunch (crime that such should ever be thought) he was given some whisky, to which he was not accustomed, in its place, and the whisky acting as an irritant to the stomach, as shown to a minor degree in "Uric Acid," fig. 58, first stopped digestion, and then produced the above result.

This is, of course, not intended to be a work on cookery, and what I have said above has been with

the intention of indicating a few directions in which others may exercise their own knowledge and ingenuity, and of removing perhaps some of the worst difficulties from the paths of those whose knowledge lies in other directions.

With regard to the gluten in Table II., it may be made into very palatable biscuits by mixing with half its weight of butter and a quarter of its weight of sugar, though if the gluten is very pure some flour may have to be added or the biscuits will be too hard, or gluten may be mixed in with the porridge or any milk pudding, &c., without its presence being noted.

Protene may be used in much the same way as gluten, and Protene, Limited, make many forms of biscuit which are very palatable, as well as Protene gingerbread and other cakes.

With regard to the convenience of these diets when away from home, it is only necessary to ask friends to provide a pint of milk and the offer of some cheese twice a day; for given 2 pints of milk and 2 ozs. of cheese there is practically certain to be enough bread and cereals, vegetables and fruit in any ordinary diet to make up all the rest.

Indeed, it often seems absurd looking to the very small amount of their day's nourishment that really comes from animal flesh, and how much is on all diets already obtained from cereals, vegetables, milk, nuts, and fruit, that people should suffer from so much fear of failure of strength and nutrition in

giving up the former source of nourishment altogether; if this fear is justified at all, it can only be so by the dense ignorance of the value of foods that prevails so widely.

As regards cost in London, the diet in Tables I. and II. is the cheaper, and that in Table III. the dearer, and this latter is quite as expensive as an ordinary flesh diet, and may easily be made more expensive still by using fruits and vegetables with a free hand and without regard to season and cost; but for those who can afford it this diet has probably some advantage over the others, in having less tendency to produce rheumatism or gout as above explained: it can be cheapened also by substituting potatoes for fruit to some extent; and it requires, or can easily be modified so as to require very little cooking.

On the other hand, the diet in Tables I. and II. is cheaper than ordinary flesh diet and may be made cheaper still if breadstuffs and potatoes are used to replace some of the milk and cheese, and if cheap fruits only are taken, and then probably 7d. or 8d. a day would cover everything.

DIET OF TRAINING AND ATHLETICS.

Naturally those who take an unusually large amount of exercise will require an extra allowance of albumens to produce the extra force, and it may be gathered from the researches on these points, which I have already published in "Uric Acid,"

that for cycling exercise and my own body, the urea produced is proportional to the distance traversed, that is to the work done, being about 1 to 1½ grains of urea for a mile, or from 3 to 4½ grains of albumen for a mile; and as my weight is about 125 lbs. this gives from ·024 to ·036 grains of albumen per lb. per mile.

And if we take it that from 75 to 80 miles is as much as I am likely to do in this line of exercise on any given day, and that 125 × 9 is my ordinary allowance of daily albumens when sedentary = 1,125 grains, then 125 × ·03 (which is half way between ·024 and ·036) and the result multiplied by 75 = 281 grains of albumen extra, and this added to 1,125 = 1,406 grains, say, 1,400 grains.

In other words, I should have to add to the diet of sedentary life the equivalent of 2 ozs. of cheese, to enable me to perform daily the above amount of exercise.

If I did not provide the proper amount of albumens I should either break down under the exercise and training, and fail to produce the required amount of force, or I should take the necessary albumens from my albumen reserves, or my body tissues, as far as they might be able to supply me, and so lose weight, and then break down when they came to an end.

I have known people who have attempted to produce considerable amounts of force while living on

a diet of cabbages and potatoes in insufficient quantities, with little or no milk and cheese, and the result has been a break-down both during the exercise and afterwards, resulting in prolonged debility with considerable cardiac and general muscular failure, and a marked loss of body weight; and no doubt the amount of weight lost would have accurately corresponded with the amounts of force and urea produced.

I do not mean to say that the above figures and quantities will hold for every one; but I give them because a rough guide is better than none, and because I wish to show the way in which my experience has led me to regard the matter; to believe as quite certain that nothing comes out of nothing, and that without the necessary quantity of albumens no force can be produced.

Practically, it comes to this, that a man who requires about 1,200 grains of albumens per day for ordinary work will want about 1,400 grains for training and the hardest exercise he is capable of doing, *i.e.*, he has to add about $\frac{1}{6}$th to his ordinary diet.

Beyond the above rough guide it may be said that if the day's work is not done easily and without any undue fatigue, and certainly without anything approaching exhaustion, an increase of albumens is indicated, and should be tried to see if it produces an improvement.

It is a good rule to take somewhere near the cal-

culated quantity of albumens in the form of milk, cheese and bread, and then, if on account of some increase of exercise there is an increase of appetite, to let that appetite expend itself on such good, useful but not strong foods as rice, potatoes and fruit.

If, however, the increased appetite is sated on such a concentrated food as cheese, too much albumen may be taken, and this may cause dyspepsia, and upset the course of training entirely.

During actual severe exercise, milk is probably the best food to take, its digestion, as we have seen reason to believe in fig. 2 goes on quickly, and its albumens are soon available for the production of force, and this, I believe, agrees with the common experience of athletes.

Milk is easily and quickly swallowed during a temporary halt, but if time is available, it should be taken only in small sips, and not in a big draught; and in this way it will be more quickly, completely and satisfactorily digested, while if any quantity above half a pint is taken in a draught it will tend to form into large masses of curd, which may not only prove slow and difficult of digestion, but by their bulk, may more or less seriously interfere with respiration and circulation.

Another way of treating milk, is to mix it with oatmeal, or a little dilute gruel, or barley water, which not only improve its chances of satisfactory digestion, but increase its nourishment value.

Cereals are good foods for training, because as we have seen, they give out a steady supply of albumens, force and urea, over a series of hours, and their salts act as stimulants to digestion, circulation and nutrition.

An absolute excess of albumens will do little harm so long as exercise is plentiful and regular, and taken under climatic conditions that favour warmth and perspiration; but under the opposite conditions it may cause high acidity and retention of uric acid, and lead to rheumatism and other troubles.

It follows absolutely, from my researches, published in "Uric Acid" and elsewhere, that a diet entirely free from all animal flesh, tea, coffee and similar alkaloid containing vegetable substances, is far and away the best of all kinds for training and athletics.

As shown in the preceding pages, the material (albumen) for the production of the required force can be made absolutely certain of, and is not lacking either in quantity or quality in the foods to be used; and at the same time the enormous practical advantage is obtained of making sure of a free circulation through all the tissues, nerve-centres and muscles alike, keeping them both well supplied with fuel, and also free from waste products and refuse, during their time of trial.

Hitherto the knowledge we now have has been applied more or less hap-hazard, or by rule of

thumb, and yet even so, it has achieved some wonderful results.

Some of these I have already recorded in "Uric Acid," and another comes to hand in an article in the *Daily News* of June 29, 1898. It is from their Berlin Correspondent, and is headed, "A Vegetarian Victory—Meat-eaters Walked off their Legs."

It then goes on to describe, how fourteen meat-eaters and eight vegetarians started for a 70 miles walking match. All the vegetarians reached the goal, and it is said "in splendid condition," the first covering the distance in fourteen and a quarter hours. An hour after the last vegetarian, came the first meat-eater, and he was "completely exhausted," He was also the last meat-eater, as all the rest had dropped off after 35 miles.

Now these results, so far as I know, were produced without any scientific knowledge, and in more or less ignorance of the facts above stated; and if so much has thus been achieved, how much more may be possible if we apply our knowledge with care and thoroughness, if we ensure sufficient albumen and force, while rigidly excluding the poisons which cause friction and jar in the machinery.

I must leave those engaged in practical athletics to test these points and record the results; and once they grasp my points and the great practical gain they promise, I feel sure that they will not be slow to do so; indeed, as the above and other records

show, the thing is already being done; but I now suggest that, with a little more scientific knowledge, it might easily be done still better.

Though even as it is, the way in which cycling and other records are made and held by vegetarians, small as their numbers are when compared with meat-eaters in this country, is really remarkable, and points, I think, to their very decided superiority both in pace and endurance.

I would also point out to pathologists that, if I am right, and if the poisons in meat and tea do cause friction, especially vascular friction, throughout the body, it is evident that training and athletics, as at present carried on, upon a diet containing these poisons, must also be carried on at a ruinous strain upon the vascular system, especially the heart and vessels; and speaking as a physician, I believe that more or less serious functional or organic trouble in this system is no very rare result of the process, even in the young and presumably healthy, as evidenced by such signs as palpitation, sleeplessness, dyspepsia and more or less hypertrophy and dilatation of the heart.

Thus it is evident from the above record that the meat-eaters, or at least the one who persisted, ran considerable danger of doing himself serious injury; while the vegetarian feeders were little, if any, the worse for their performance.

I by no means wish to assert that men or animals

who live entirely on a uric acid free diet may not dilate and strain their hearts by over-exertion; comparative anatomy alone contains sufficient evidence in the moderator band of the herbivorous heart, that such a thing is possible; but I do maintain, that for reasons which are as clear as daylight, the meat-eater and tea-drinker is much more likely to do it, and to do it badly. He may produce the same amount of force as the man who is free from these poisons; but he will consume a greater quantity of albumen in doing it, and he will produce it at a far greater cost in pressure and strain upon all his tissues and organs, so that they will both wear out sooner, and more frequently give rise to functional disturbance, as the result of the treatment to which they are subjected.

Obesity.—Not only is there no necessity for those who make use of these diets to become stout, but they can easily be modified, so as to reduce the obesity of those who suffer from other diets.

Of course, if anyone begins on one of the above diets containing two or more pints of milk, and takes freely also of cream and butter, they may easily increase a good many pounds in weight even in a month or two.

And I mention this specially to point out that such increase in weight, if due to fat, is no proof of satisfactory nutrition, and does not show that the quantity of albumens daily consumed is sufficient;

and under these circumstances the only proof that the supply of albumens is sufficient is a more or less constant feeling of abundant strength, with ample powers of endurance, which, by the way, are almost never met with in those who are too stout.

Stout people have also in my experience very often decidedly high-blood pressure, and it is at least probable, as I have elsewhere suggested, that the cause of the high-blood pressure, namely collæmia and defective capillary circulation, is also the cause of the stoutness.

Defective or obstructed capillary circulation causes on the one hand high-blood pressure, and on the other deficient metabolism, or combustion in the tissues (see "Uric Acid," prev. ref. p. 507); one effect of which may, under certain circumstances, be an accumulation of uncombusted material, in the shape of fat. It may be thus no mere coincidence that stout people so often have high-blood pressure, or that stoutness has become connected in the popular mind with a tendency to apoplexy.

It follows also from my first principles, that those who have such defective circulation cannot have much power of endurance.

But if the weight tends to make a decided increase on any such diet, and it is not desired that the weight should increase further, reducing the butter and cream and skimming, or, better

still, separating the milk, is generally sufficient to bring it to a standstill.

But those who are already too stout and wish to reduce, will have to further modify any of the above diets.

Thus taking Table I., the milk will have to be reduced, and the cream separated from that taken, and cheese may be specially obtained which is poor in fat, or made from skim milk.

Bread must be reduced, or even entirely replaced by rice, which is poor in fat, together with protene and gluten, which are practically free from it. Thus:

1 pint milk ..	3	per cent.	of albumens	= 262 grs.
2 ozs. cheese ..	33	,,	,,	= 281 ,,
½ oz. gluten ..	90	,,	,,	= 180 ,,
2 ozs. protene ..	85	,,	,,	= 631 ,,
4 ozs. rice ..	5	,,	,,	= 86 ,,
				1,440
A little acid fruit, say				30 grs.
				1,470

In this way a sufficient supply of albumens is obtained with very little fat and a reduced quantum of starches, and the patient supplies what may be required in this direction from his own tissues, just as he would on the dangerous diet of meat and hot water that has been used for the same purpose. But he escapes the great dangers of this latter diet, which are due to the xanthin, uric acid and other effete nitrogen contained in the flesh, as these

poisons are practically completely absent from the above diet table; and in this way he can reduce his weight with much greater safety and considerable ease. If necessary, gluten and protene may be increased, diminishing correspondingly the milk and the cheese which contain most of the fat. The object of allowing some acid fruits is to stimulate, as stimulation will tend to improve circulation, nutrition, and metabolism in general, and facilitate the breaking up and removal of the fat deposited.

In this way weight can be safely and satisfactorily reduced without any failure of nutrition or strength, and without any danger from the deadly after-effects of the animal tissue poisons in the pure meat diet.

A great deal has been said and written of late about the cure of tuberculosis by fresh air and overfeeding.

And no doubt such overfeeding, if it makes the human fire, so to speak, roar up the chimney, may help to cure a local tuberculosis, as I have suggested in "Uric Acid," p. 328; but I should like to point out that it is by no means necessary to abandon a uric acid free diet to get such overfeeding, as the diet in the table just given is a very ample one for persons of ordinary weight, and as almost every item in it—milk, cheese, protene, and gluten—could be doubled, or even trebled, if necessary,

there is no doubt that the required albumens can be obtained from these substances.

I would also point out that this stimulation of combustion is a temporary expedient for a temporary object, and that once the destruction of the microbe has been accomplished, the excess of food has almost of necessity to be considerably reduced, or disease would be produced in other directions by the accumulation of the waste products of such excessive combustion; and it follows from all my previous arguments, that these waste products will be both less in quantity and less injurious in quality if the necessary albumens have been obtained from a uric acid free source.

ALCOHOL, TOBACCO, AND OTHER STIMULANTS.

We have already seen that stimulants such as acids do not produce force, they merely alter its distribution in time. When an acid causes feelings of well-being and an increased excretion of urea, it merely causes the metabolism of a certain amount of albumen which was there before and independent of it; it merely alters the time relation of the metabolism of this albumen, converting it quickly into available force and urea in one hour, while without the stimulant the same albumen might have been slowly converted into force and urea over three or four hours.

But after the force has been produced and the urea excreted, the body is poorer in albumens than it would have been at the same hour if no stimulant had been taken; and the urea curve falls more quickly, as we have seen in chapter i., fig. 5, than if there had been no stimulation.

Such stimulation therefore is followed so long as no fresh albumen is introduced from without, by an exactly corresponding depression, as the body has to economise in the following hours to make up for the increased loss of force in the hour of stimulation.

It is no doubt sometimes necessary for the preservation of life that an extra quantity of force should be available in a given time, and nature provides for this need by keeping a reserve of albumens in the blood and tissues, and the natural stimulant of a call for extra force and exertion brings this reserve out and uses it up; a corresponding rise of urea showing what has taken place.

But as there has been no fresh introduction of albumen and force, the body is poorer in these constituents than before, and has to economise and rest or obtain fresh supplies from without.

And if this is the effect of the natural stimulant, a call for exertion, it must also be the effect of the unnatural stimulant, alcohol; this can introduce no albumen and force, it merely affects circulation and nutrition, and the metabolism of the albumens

already in the body, and this call on the resources of the body must be followed by a corresponding depression or economy in the future.

It follows from this that all artificial and unnatural stimulation is wrong, it merely calls out the reserves of force and makes the body poorer in the following period to a corresponding extent, every up is followed by a down, and nothing is really gained by stimulation.

There is, however, one exception to this rule, and that is, when the body is much in need of fresh supplies, and urea has run down so much that force for digestion is scarcely available; a stimulant may here do good by calling out some of the remaining reserves, thus furnishing the necessary force for digestion, and fresh albumens are thus brought more quickly into circulation, and nutrition moves up again.

But even here artificial stimulation may be replaced by rest and economy of force, and is not really necessary if such rest is possible.

Now we have seen that stimulation is merely a call on the reserves of force already in the body, and the more these reserves have already been called upon, the greater will be the stimulus required to produce still more; but if the alcohol was itself a force producer, the effect should be the same each time for the same dose.

A food introduces force from without; a stimulant

merely calls out force already in the body, and athletes know that they must not take stimulants till near the end of the race, for once their final reserves have been called out nothing is left, and collapse results; but if they took milk in place of alcohol fresh power would result, and go on resulting with each dose of milk.

Now here is a fundamental distinction between a food and a stimulant, and one which is already well known to athletes; it is a point also which can be easily tested by anyone who will take the trouble to do it.

A stimulant increases available force only so long as there is albumen available for it to act upon.

Force is thus proportional to the quantity of food (if within the limits of digestion); but it is not proportional to the quantity of stimulant, and it bears a constantly smaller and smaller proportion to it as stimulation is repeated.

It is useless to argue that force is got out of sugars and starches quite apart from the temporary rise of urea they indirectly produce (fig. 4). If this were so then they would sustain life indefinitely and apart from albumens, and these last would not be a *sine quâ non* of life; but we know that the contrary has been proved by physiologists, and it can be proved again and again by anyone who will repeat either the experiments of the athletes, or those of which I give figures. Neither alcohol nor sugar is a food in the sense that albumen is so.

Now what do we see in nature? If a man is only slightly tired with falling urea but his reserves are still fair, a teaspoonful of brandy may set him going for some distance; but at the end of that time his reserves will be considerably reduced, and three or four teaspoonfuls of brandy will now have less effect than the one.

Now just the same holds for those who are constantly resorting to stimulants, they are constantly to some extent drawing on their reserves, and the amount of stimulant will constantly have to be increased as the reserves get less and less, and this again is exactly what we find in nature.

It has been truly said that the man who relies upon stimulants for strength is lost, for he is relying upon a reserve fund which is not completely replaced, and physiological bankruptcy is bound to come sooner or later.

Now this is exactly what the stimulants such as tea, coffee, alcohol, tobacco, opium and cocaine do for those who trust in them; they none of them introduce albumen, which is, or may become available for conversion into force and urea, they merely aid the calling out of the reserves.

We may consider that alcohol and tobacco are mere stimulants, and by improving the circulation like the acids previously spoken of, call out a certain quantity of albumen, force, and urea (see fig 5), but tea and coffee are worse, much worse; for though at

first they act as stimulants in much the same way as the acids and alcohol, later on they come into the blood as the very poison uric acid, which is the cause of much of the depression; for we have seen above that fatigue is partly due to deficiency of albumens and also partly due to deficient tissue circulation, rendering the stock of albumens useless because they cannot get to the tissues, and this defective tissue circulation is the effect of uric acid, to which the xanthins in tea and coffee are equivalent.

The first effect of these xanthins is to act as acids, and clear the blood of uric acid, hence they are stimulants; later they come into the blood as uric acid and increase the depression.

Practically those who cannot get through their daily work without calling out their reserves with alcohol or tobacco, the action of which I have considered in "Uric Acid," are weak or diseased, and are entering on the road to physiological bankruptcy. And who are the people that are thus constantly calling on their reserves? Not those that live on the diets in the above Tables, far from it, for those who go on these diets commonly give up alcohol and tobacco, if they used them before when on other diets.

It is the flesh eaters who want the stimulants and the reason is simple, for on all flesh diets they are constantly taking that terrible poison, uric acid or the xanthins, and these are first stimulants

and afterwards depressants; they first unnecessarily call out the reserves and then plunge all into depression and feeble nutrition, by blocking the circulation, and while this is going on other stimulants, as alcohol and tobacco, or tea, have to be called in to keep things going. (See also p. 37.)

It follows that the only way to get clear of stimulants is to give them up altogether; if you keep on any of them you must be led to take more and more, and gradually to add others which are more powerful.

On the other hand, to live on one's income, to have one's reserves entire and untouched for that evil day of trial which is sure to come to all, to work calmly and steadily without fuss and without friction is alone sufficient to make life worth living; and so great is the difference between physiological solvency and physiological bankruptcy, that I do not exaggerate when I say that the knowledge of how to attain to the former has repaid me a thousand times over for all the time and trouble expended on experiments. Then again, the physiologically solvent know to the full the joys of a strong and useful life, while the bankrupt knows these joys but once, in the memory of what he was before he began to call on his reserves, and as these reserves get smaller and smaller, the stimulants, and even the more powerful ones, such as morphine and cocaine, which he eventually calls in, fail ever more and more to

bring him even for a moment to the level of physiological health, which the solvent man enjoys continually.

But the difference must be felt and cannot really be described, and I know also that there are conditions of ignorance combined with prejudice, which are too deep for words, and on which mere words produce no more effect than water on the back of the proverbial duck, and that the people living under these conditions may for practical purposes be divided into those who do not know, and those who do not want to know.

Now the case of the latter is at once hopeless; but for those who are simply ignorant, and have no objection to knowledge if they can obtain it, a demonstration, which is far more powerful than words, can always be obtained by putting in force the calculation of albumens for body weight and watching the result for themselves. It will not do to measure milk by the cupful, or to imagine that an ounce of cheese is no larger than a hazel nut; these foods must be measured and weighed at first till the proper quantity comes to be accurately known at sight.

Then part, at least, of the *bonâ fide* doubts of the ignorant, may be due to the fact that numbers and numbers of people who call themselves "vegetarians," or others who, for one reason or another have abjured flesh as food, have had no real physio-

logical knowledge, and have only too often quite failed to put an adequate quantity of albumens in place of those they left off.

The result has been that their nutrition has often failed either to quite satisfy themselves, or to commend their methods to others.

Here, also, probably originates the doubt one not infrequently hears expressed, as to whether patients can "stand" the diet; I can only say that the great majority of people I see have no difficulty in digesting most of the foods enumerated in the above Tables; and that if they take sufficient of these, and digest them, they need have no anxiety, either about nutrition or strength, and they are likely to find their powers of endurance much increased.

No doubt those whose bodies are full of urates, as the result of years of flesh diet and tea, are likely to get pale at first on the new diet, as it will bring a lot of uric acid into their blood on its way to be eliminated; but this is merely the evil of the old diet being brought out, and if they persevere they will in 12-18 months have a better colour than most meat-eaters, as the uric acid having been eliminated, their blood will recover and improve. (See "Uric Acid," chapter xii.)

And then again, if the muscles produce force more smoothly, continuously and pleasantly, with less of friction on a supply of albumens which are free from the poisonous products of dead animal

tissues, and if muscular life becomes more pleasant from this cause, how much greater is the value of this physiological solvency, when we realise that it applies also to the great nerve centres, the organ of the mind, and find that here also, the result is better work, better and more easily performed, and not only better work, but a better, more kindly, true and noble relation to all the conditions and phenomena of life.

Indeed, I think it is not too much to say that, just as in regard to force and nutrition, insolvency leads to ever less and less work, worse and still worse performed, as the reserves are, one after the other called out and used up; so in regard to mind, does insolvency lead to ever less and less mental range and activity, and worse than all, to a narrow, mean, selfish view of the world and all it contains; and this mental attitude is, in many cases, the prelude to that complete loss of mental power and balance—insanity. Our asylums are full to overflowing, and we are building new ones day by day. Would it not be wiser to spend a little money in cutting off the stream at its source? Should we not put our insane population on a diet which at least does not increase the mischief?

On the other hand, perfect, complete and continuous solvency of mind and body, lifts both to ever higher and higher levels of power, beauty, and knowledge of the truth; forming at once the highest

attainable development of the *mens sana in corpore sano*, and leading ever upwards "into the higher sunlit slopes of that mountain which has no summit, or whose summit is in heaven only" (Sartor Resartus).

In the foregoing pages I have not attempted to give a complete physiological explanation of all the conditions; I have tried rather to put the knowledge we have into the most useful form for practical purposes. For these purposes, I think we may say that the force produced by muscles is, other things equal, proportional to the albumens available.

The same quantity of albumens will produce the greater result the less the friction in the machinery they have to overcome, that is to say, when the muscles are in training the same excretion of urea will correspond to a greater number of miles covered, than when the muscles are soft and out of use.

Similarly, a given quantity of albumens will produce a greater result when the circulation of the blood is free and complete, that is when it is clear, and kept clear of the obstructing and friction-causing xanthins and uric acid.

And when the circulation is thus obstructed, a greater quantity of albumens will be used up by the heart muscle in the increased work imposed upon it, and by so much, less albumen will be available for the body muscles in general.

It follows from this that 1 oz. of albumen from

bread, milk, or cheese, will produce a greater external result than a like amount of albumen from the tissues of dead animals.

Man has no doubt been misled by the stimulating properties of animal tissues and their extracts, to believe just the reverse of the above, and this is specially noteworthy in the case of beef-tea, which has been almost universally used in spite of the fact that it contains little or no albumen available for force production, and is thus nearly as pure a stimulant as a glass of wine.

But the facts now admit of no doubt, and can be easily noted and verified; though the mournful fact that the deadly path of stimulation once entered upon has only too often led to the complete ruin of mind and body, can scarcely, I think, at this period of the world's history require further demonstration.

INDEX.

LONDON:

JOHN BALE, SONS AND DANIELSSON, LTD.